

FLORA OF PANAMA

BY
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AND COLLABORATORS

PART IV

Fascicle 1

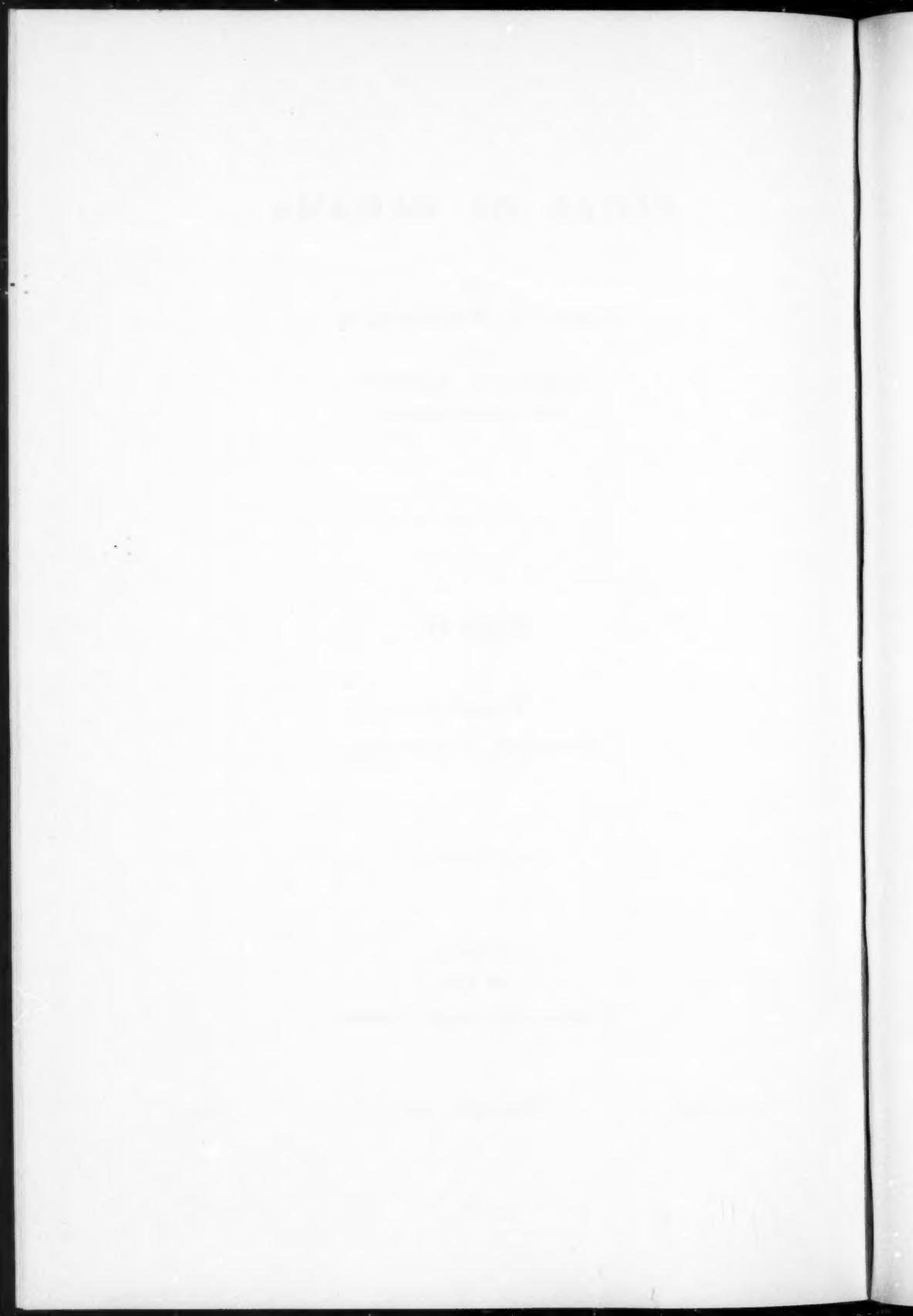
PIPERACEAE (T. G. Yuncker)

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FLORA OF PANAMA

Part IV. Fascicle 1

PIPERACEAE¹

By T. G. YUNCKER

Herbs, shrubs, or small trees, not infrequently repent or scandent, often with nodose stems, glabrous or pubescent, vascular bundles scattered; leaves mostly alternate, sometimes opposite or verticillate, simple, usually entire, ranging in size from less than 1 cm. up to 30-40 cm. or more long, often with glandular or pellucid dots; stipules lacking or present and commonly more or less adnate to the petiole; flowers very small, usually green, perfect or unisexual, in racemose or more commonly spike-like inflorescences, these usually somewhat fleshy, pedunculate, terminal or leaf-opposed, sometimes axillary or multiple on a common peduncle; the flowers mostly densely crowded, each in the axil of a usually peltate or sub-peltate, sessile or stipitate, occasionally adnate or concave bract; perianth none; stamens usually 2-6, filaments mostly free, the anthers terminal, erect, 2-celled; ovary sessile or stipitate, 1-celled, 1-ovulate; fruit drupaceous, small.

The Piperaceae, one of the larger families of flowering plants, is pantropic in its distribution. Species are especially abundant in Latin America. They extend from the Keys of Florida through the West Indies, Mexico, and Central America, southward to Chile and Argentina. They occur in greatest number throughout northern South America from Brazil to Peru and northward to Panama and Costa Rica. Some species are widespread in their occurrence but each country has a rather large number of endemics. The total number of valid American species is unknown but unquestionably amounts to many hundreds and may approximate 2,000 or more.

A number of species of widespread distribution; e.g., *Piper aduncum*, *P. bipinnatum*, *P. marginatum*, and others appear to exhibit an infinite capacity of variation in minor characters of leaf size, shape, and indumentum. The extremes often appear quite distinct in themselves but study of large numbers of collections may reveal intergradations to such a degree that the extremes lose their seeming significance. The writer has been reluctant to maintain species or even varieties established by previous workers on such apparent variations when sufficient evidence indicates intergradations. It is probable that errors of judgment have been made but it is felt that such errors are on the side of conservatism. On this basis,

¹Issued March 31, 1950.

a number of previously described species have been reduced to synonymy. At the same time, a number of novelties have been described as new to science. It is believed that with greater abundance of material, especially mass collections, and with correlated field study still further reductions may be in order. On the other hand, such studies may prove the validity of species which now appear to be the same.

Small collections had been made in Panama previous to 1800 especially by Née and by Haenke, and around the middle of the last century larger collections were prepared by Seemann, Fendler, Hayes, and others. However, collecting in Panama on an extensive basis did not get under way to any extent until after 1900.

Miquel, the great Dutch authority and monographer of the Piperaceae during the first part of last century, studied some of the earlier collections. Casimir DeCandolle, third in line of the great Swiss family of botanists, following Miquel's death, published in the DeCandolle 'Prodromus' in 1869 a monograph of the Piperaceae. Included in this publication were all of the species then known from Panama. Following this work, there appeared an almost continuous stream of papers by DeCandolle embodying the descriptions of hundreds of new species based on specimens sent to him by collectors as they explored farther and farther into botanically unknown areas. Following DeCandolle's death in 1918, Professor William Trelease, of the University of Illinois, undertook the study of the family, especially as it is represented in the Americas, and published a number of papers including the descriptions of many new species.

The earliest paper to deal exclusively with the Piperaceae of Panama was prepared by DeCandolle and published posthumously in 1920. This included the descriptions of a number of new species based on collections made by Pittier and by Maxon in the early part of the century. Subsequently, large collections were made by Standley, Killip, Piper, and others. From a study of this rather considerable accumulation of material, Trelease in 1927 presented a monographic study of the Panamanian Piperaceae which included 139 species and a number of varieties. Woodson and his associates at the Missouri Botanical Garden have more recently made extensive collections. These have also been studied by Trelease who has published more than 70 new species and a number of varieties based on this material. Thus, according to Trelease, more than 200 species are represented in Panama.

An attempt has been made in preparing the present paper to account for all species previously reported. Ninety-five species of *Piper*, 1 of *Ottonia*, 2 of *Pottiomorphe*, 1 of *Sarcorbachis*, 1 of *Anderssoniopiper*, 72 of *Peperomia*, 22 varieties of *Piper* and 7 of *Peperomia*, making a total of 172 species and 29 varieties, are considered as valid in the present treatment.

For the present study the writer has had the loan of the collections at Gray Herbarium of Harvard University, University of Illinois, Missouri Botanical Garden, New York Botanical Garden, and the United States National Museum. In addition, he has also had the loan of a number of critical specimens from Kew. He had the use of notes made by Trelease during his studies of type material in

European herbaria and was also given a grant by the Research Grant Fund of DePauw University. For the loan of specimens and all other assistance given him, the writer expresses his thanks.

KEY TO GENERA*

- a. Stigmas 2-5 (mostly 3-4); floral bracts various, often more or less pubescent; plants more or less woody, commonly shrubby or vine-like, or less frequently herbaceous.
 - b. Inflorescence leaf-opposed.
 - c. Inflorescence spicate; fruit sessile..... 1. PIPER
 - cc. Inflorescence racemose; fruit stipitate..... 2. OTTONIA
 - bb. Inflorescence axillary, spicate.
 - c. Spikes several on a common peduncle..... 3. POTHOMORPHE
 - cc. Spikes one, or, if more than one, not on a common peduncle.
 - d. Spikes solitary..... 4. SARCORHACHIS
 - dd. Spikes 2 (or more?), superposed, axillary..... 5. ANDERSSONIOPIPER
- aa. Stigmas 1 (may occasionally be cleft to simulate 2), stamens 2; floral bracts mostly round-peltate, glabrous; plants herbaceous, mostly comparatively small..... 6. PEPPEROMIA

1. PIPER Linnaeus

PIPER L. Gen. Pl. ed. 1. 333. 1737.

Shrubs or trees, occasionally subherbaceous, rarely scandent, often nodose; leaves alternate, simple, with rare exceptions entire, a few species peltate, frequently with one side attached to the petiole at the base several mm. lower than the other, smooth to rugose or bullate above and lacunose beneath, glabrous or sparsely to densely hairy, often scabrous, frequently sparsely to densely glandular-dotted, palmately nerved or more commonly pinnately nerved from the lower half or two-thirds, or throughout, usually somewhat venulose with finer cross-connecting and anastomosing nervules; petiole of various lengths, rarely lacking, commonly more or less vaginately-grooved at least at the base and often to the blade, the margins of the groove wing-margined, the wing very narrow or apparently lacking, or broad and conspicuous; spikes leaf-opposed, cylindrical or rarely globose or subglobose, 1-10 mm. or more thick and up to 50 cm. or more long; peduncle from less than 5 mm. up to several centimeters long; rachis commonly somewhat ridged between the flowers, the ridges low and smooth or papillate to fimbriate; flowers sessile and perfect (American species) or imperfect (Old World species); usually densely congested, in the axis of variously shaped bracts, the bracts sometimes glabrous but more commonly pilose or fimbriate; stamens 2-5; ovary 1, glabrous or sometimes papillate or pubescent; stigmas 2-4, rounded to filiform, sessile or on a short and thick to elongated and slender style; fruit variously shaped, one-seeded, drupe-like, with a thin pericarp and somewhat hardened endocarp.

PRIMARY KEY TO SPECIES OF PIPER

- a. Ovary and fruit stylose I. Spp. 1-18 (pp. 5-14)
- aa. Ovary and fruit not stylose.
 - b. Leaves scarcely peltate.
 - c. Leaves palmately nerved, or plinerved within the lowermost 5 mm. II. Spp. 19-25 (pp. 15-20)
 - cc. Leaves pinnately nerved.
 - d. The principal branches of the midrib arising from somewhat below the middle to the upper third of the blade.

*All keys in this paper are to be considered as artificial.

- e. Leaves mostly 20-25 cm. or more long \times 10-20 cm. or more wide, base equi- or unequilaterally lobed (shallowly so in a few species) III. Spp. 26-34 (pp. 20-26)
- ee. Leaves mostly smaller or, if large, not lobed at the base..... IV. Spp. 35-82 (pp. 30-60)
- dd. The midrib more or less equally branched to the upper fourth or throughout V. Spp. 83-93 (pp. 61-69)
- bb. Leaves distinctly peltate VI. Spp. 94-96 (pp. 70-71)

I. KEY TO SPECIES HAVING STYLOSE OVARIES AND FRUIT

(In a few species included here the styles may be very short or easily deciduous. Such questionably stylose species have been also included in the non-stylose section of the key.)

- a. Leaves rugose-bullate..... 1. *P. PESARESANUM*
- aa. Leaves not rugose-bullate.
 - b. Leaves peltate.
 - bb. Leaves not peltate.
 - c. Spikes 15-20 cm. or more long; leaves 10 \times 20 cm. or more; styles short.
 - d. Petioles, twigs, etc. more or less warty-verrucose..... 30. *P. IMPERIALE*
 - dd. Petioles, twigs, etc. not warty-verrucose.
 - e. Twigs glabrate; nerves 6-8 on each side
 - f. Leaves elliptic, base oblique, cordate-auriculate..... 2. *P. ALBOPUNCTULATISSIMUM*
 - ff. Leaves ovate, base not oblique or auriculate..... 34. *P. PITTIERI*
 - ee. Twigs densely brown-hairy; nerves 5-6 on each side..... 31. *P. TARDENS*
 - cc. Spikes and leaves much smaller.
 - d. Spikes mostly 3 cm. or more long when mature.
 - e. Leaves pinnately nerved throughout; plants entirely glabrous; fruit tetragonal; bracts cupulate, glabrous..... 3. *P. DARIENENSE*
 - ee. Leaves pinnately nerved below the upper third (or sometimes throughout in *P. phytolaccaeifolium*).
 - f. Young twigs and/or leaves hairy.
 - g. Spikes 6-8 cm. long; peduncle 1.5-2 cm. long..... 4. *P. LINCOLNENSE*
 - gg. Spikes 3-4 cm. or less long; peduncle 0.5-1 cm. long.
 - h. Leaves ovate, 7-12.5 cm. wide; twigs retrorsely hirtellous..... 5. *P. PERVENOSUM*
 - hh. Leaves lance-elliptic, 3.5-5 cm. wide; twigs villous..... 6. *P. PERULIGERUM*
 - hh. Leaves elliptic-obovate or obovate, 7-12 cm. wide..... 7. *P. EXIGUICAULE*
 - ff. Entirely glabrous.
 - g. Leaves ovate, base rounded; spikes 5 cm. or more long..... 8. *P. CRASSINERVUM* var. *TOCOTANUM*
 - gg. Leaves not ovate, base acute to acuminate.
 - h. Leaves lance-elliptic; spikes 2-4 cm. long..... 9. *P. PHYTOLACCAEFOLIUM*
 - hh. Leaves obovate, strongly revolute..... 10. *P. MACROPUNCTATUM*
 - dd. Spikes mostly 2 cm. or less long when mature.
 - e. Leaves with 6-8 main lateral nerves.
 - f. Leaves 10 cm. or more wide, nerves beneath puberulent..... 11. *P. LATIBRACTEUM*
 - ff. Leaves less than 5 cm. wide, nerves beneath glabrous..... 12. *P. CANDELARIANUM*
 - ee. Leaves with 3-5 main lateral nerves.
 - f. Leaf base 5-10 mm. shorter on one side, glabrous..... 13. *P. MAGNANTHERUM*
 - ff. Leaf base essentially equilateral, or if unequal more or less pubescent.
 - g. Young twigs and/or leaves hairy.
 - h. Leaves more or less long-ciliate, base acute..... 14. *P. GARAGARANUM*
 - hh. Leaves not ciliate, base more or less cordulate.
 - i. Twigs, petioles, etc. minutely hirtellous..... 5. *P. PERVENOSUM*
 - ii. Twigs, etc. densely villous.
 - j. Leaves about three times longer than wide, oblong-lanceolate..... 15. *P. PUBISTIPULUM*
 - jj. Leaves about 2 times longer than wide, elliptic..... 16. *P. COLON-INSULAE*

gg. Young growth glabrous.
 h. Leaves mostly 6 cm. or more wide.
 i. Cavés broadly elliptic, abruptly short-acuminate,
 subrugose..... 17. *P. DISTIGMATUM*
 ii. Leaves ovate, gradually acuminate, not rugose..... 18. *P. DAVIDSONII*
 hh. Leaves mostly narrower..... 9. *P. PHYTOLACCAEFOLIUM*

1. *PIPER PESARESANUM* C.DC. in Engl. Bot. Jahrb. 40:247. 1908, as *petaresanum*, obviously an error.

Piper fluvii-initii Trel. in Ann. Mo. Bot. Gard. 27:291. 1940.

A shrub or small tree, 3-8 m. tall, nodose; upper internodes rather short, thick, subreflexed-hirtellous with an intermixture of scattered long hairs; leaves elliptic-to round-ovate, 5-11 cm. wide \times 13-17 cm. long, apex sharp-acuminate, base rounded, subinequilaterally obtuse, one side 1-2 mm. shorter, bullate-lacunose, pinnately nerved from the lower half, the nerves about 6 or 8 on each side, rusty-villous above, at least along the nerves, rather densely so beneath, especially along the nerves, with a mixture of long and short hairs, margin ciliate, drying firm, dark, opaque; petiole 10-20 plus 1-2 mm.² long, villous, vaginate and narrowly winged toward the base; spikes 8-10 mm. thick \times 9-13 cm. long; peduncle stout, 1-2 cm. long, villous; bracts oblong-subligulate, pilose to near the subacute, curved apex; fruit subcylindrical, glabrate, stigmas 3, elongated, recurved on a moderate or short, somewhat sparsely hispid or glabrate style.

Western Colombia and Panama, commonly at rather high altitudes.

CHIRIQUI: trail from Cerro Punta to headwaters of Rio Caldera, alt. 2250-2500 m., Allen 1445; Bajo Chorro, Boquete District, alt. 2100 m., Davidson 204.

This species rather closely resembles *P. lacunosum* of western South America but differs in the type of pubescence, shape of the bracts, and more elongated fruits. The Chiriquí specimens agree in all respects with those seen from South America.

2. *PIPER ALBOPUNCTULATISSIMUM* Trel. in Ann. Mo. Bot. Gard. 27:287. 1940.

A somewhat nodose shrub, 4 m. tall; upper internodes glabrous, sparingly warty-papillate; leaves elliptic, apex acute, base obliquely cordate-auricled, one side about 5 mm. shorter at the petiole, the larger side about equaling the petiole, about 18 cm. wide \times 28-30 cm. long, pinnately nerved from below the upper third, the nerves 6-8 on each side, submarginally loop-connected and with numerous cross-connecting and anastomosing nervules, glabrous above, the nerves beneath puberulent or crisp-pubescent, marginal ciliation lacking, sparsely yellow-glandular-dotted on both sides, microscopically white-dotted above when dry, drying rather firm, subtranslucent; petiole 45 plus 5 mm. long, winged-vaginate to near the blade, sparsely warty; spikes 5 mm. thick \times 25 cm. long; peduncle

²The base of the blade in many species of *Piper* is unequal on the two sides with one side somewhat shorter at the petiole. The petiolar length is given plus the difference in length between the two sides.

about 4 cm. long; bracts triangular-subpeltate, ciliate, the pedicel broad, concave; stigmas 3, linear, on a short, stout style.

Known only from the following locality.

COCLÉ: north rim of El Valle de Antón, alt. 600-1000 m., *Allen* 1652.

3. *PIPER DARIENENSE* C.DC. in DC. *Prodr.* 16¹:374. 1869.

Ottonia glaucescens Miq. in Seem. *Bot. Voy. Herald*, 200. 1854, not *Piper glaucescens* Jacq. *Piper dariense* C.DC. in *Candollea* 1:168. 1923.

Piper laxispicum Trel. in *Contr. U. S. Nat. Herb.* 26:24. 1927.

Piper laxispicum var. *latifolium* Trel. loc. cit. 1927.

Piper Permari Trel. in *Ann. Mo. Bot. Gard.* 27:295. 1940.

Piper fagopyricarpum Trel. loc. cit. 28:426. 1941.

A glabrous shrub, mostly scarcely 0.5 m. tall; stems simple or occasionally branched, 2-3 mm. thick, somewhat finely striate, greenish; leaves oblong-elliptic, subovate or lance-elliptic, 3-7 or sometimes 8 cm. wide \times 12-19 cm. long, apex attenuately sharp-acuminate, base narrowed, subequilaterally acute or rounded and obtuse, minutely auriculate at the petiole, pinnately nerved throughout, the midrib rather prominent beneath, the lateral nerves slender, 6-9 on each side, divergent and submarginally loop-connected, drying green above, paler and subglaucous beneath, membranous, translucent; petiole mostly scarcely 5 mm. long, longitudinally striate, scarcely vaginate at the very base; spikes 3-5 mm. thick \times 3-5 cm. long when mature; peduncle about 5 mm. long; rachis smooth or obscurely papillate; bracts cupulate, glabrous; fruit mostly exserted, free, globose-tetragonal, smooth or obscurely papillate, stigmas short, 3-4, on a short, stout style.

Panama and northern Colombia.

BOCAS DEL TORO: upper Changuinola River, *Permari* s. n.; vicinity of Chiriquí Lagoon, *von Wedel* 1042. CHIRIQUI: vicinity of Puerto Armuelles, alt. 0-75 m., *Woodson & Schery* 852. CANAL ZONE: Barro Colorado Island, Gatún Lake, *Standley* 31375; *Mexia* 6551; *Bailey & Bailey* 88. PANAMÁ: Indio, Madden Lake, *Miller* 2065—leaves maximum size, as described. SAN BLAS: forests around Puerto Obaldia, alt. 0-50 m., *Pittier* 4288.

The type specimen did not have a sufficiently matured spike to show the characters of the fruit, which are significant in this species. The description of the vegetative characters, however, agrees in all respects with the other specimens included here. It was reported by Seemann as being used by the Indians for stupefying fish. Mexia made the same report for the specimen she collected on Barro Colorado Island.

4. *PIPER LINCOLNENSE* Trel. in *Field Mus. Nat. Hist. Bot. Ser.* 18:347. 1937.

A shrub (?); flowering internodes moderately slender and short, obscurely retrorsely hirtellous on one side, the other side papillate glabrescent; leaves broadly elliptic or ovate-elliptic, apex short-acuminate, base slightly inequilaterally cordulate, 7.5-10.5 cm. wide \times 16-20 cm. long, pinnately nerved from below the upper third, the nerves about 6 on each side, rather prominent beneath, glabrous above, glandular-dotted and crisp-pubescent beneath, especially along the nerves, not ciliate, drying dull, papery, translucent; petiole 1.5-2 cm. long, rather densely

reflexed-hirtellous, vaginate to the blade; spikes 3-4 mm. thick \times 6-8 cm. long, peduncle 1.5-2 cm. long, thinly and obscurely hirtellous; bracts triangular, the pedicel broad and concave, glabrous; fruit depressed, slightly flattened laterally with the rachis, stigmas 3, slender, on a short style.

Known only from Lincoln Creek, Bocas del Toro.

BOCAS DEL TORO: Lincoln Creek, Changuinola Valley, *Dunlap* 408.

The broadly elliptic leaves, pubescent beneath, and stylose fruits characterize this species.

5. *PIPER PERVENOSUM* C.DC. in *Candollea* 1:268. 1923, name only; Schroeder, in *Candollea* 3:137. 1926.

A shrub; flowering internodes short, moderately slender, retrorsely hirtellous; leaves ovate, apex gradually acute, base subequilateral, rounded, obtuse or subcordulate, 7-12.5 cm. wide \times 13-18 cm. long, glabrous on both sides or with the nerves beneath obscurely and minutely hirtellous, pinnately nerved from the lower half or slightly above, the nerves 3 or 4 on each side, with shorter intermediates, and minor lateral nerves to near the apex, nervules very numerous and closely spaced as seen by transmitted light, glandular-dotted, the glands comparatively large, drying gray-green, firm, translucent; petiole 5-20 mm. long, stout, vaginate-winged to the blade, retrorsely hirtellous; spikes 3-4 mm. thick \times 3 cm. long; peduncle 5-10 mm. long, hirtellous; bracts triangular-lunulate, papillate; ovary subglobose, stigmas small, on a short style.

Known only from the following locality.

SAN BLAS: San Blas coast, high hills back of Puerto Obaldia, alt. 50-200 m., *Pittier* 4302

The gray-green twigs and ovate, finely venulose leaves are distinctive features of this species.

6. *PIPER PERULIGERUM* Trel. in *Ann. Mo. Bot. Gard.* 27:295. 1940.

Small and suffruticose; twigs, petioles and leaves at first rusty subtomentose-villous; internodes short and rather slender; leaves lance-elliptic, apex long-attenuate, base obliquely cordulate, one side 2-3 mm. longer, 3.5-5 cm. wide \times 11-14 cm. long, pinnately nerved from the lower half, the nerves 3-5 on each side, with strong cross-connecting-anastomosing nervules, becoming slightly pouched between veins, the midrib above moderately pubescent, subvillous beneath, the nerves rather strongly so, the hairs staring and of various lengths, the longest nearly 1 mm. long, drying papery, translucent; petiole scant 3 plus 2-3 mm. long, densely villous; spikes 3 mm. thick \times 2.5 cm. long; peduncle 3 mm. long; stigmas on a short style.

Known only from the following locality.

BOCAS DEL TORO: Isla de Colón, *Woodson, Allen & Seibert* 1939.

The above description is drawn largely from the type description by Trelease inasmuch as the fragment at Illinois consists of two leaves only. Trelease indicated that the type is at the Missouri Botanical Garden but it has not been seen by the writer.

7. *Piper exiguaule* Yuncker, sp. nov.

Frutex, 30 cm. altus; foliis obovatis vel elliptico-obovatis, apice subacutis, basi subaequilateralibus, ad petiolum abrupte acutis, a tertio supero deorsum pinnatum venosis, venis utrinque ca. 6, supra dissite villosis, subtus ad venas crispe vel adpresso pubescentibus, sat obscure glanduloso-punctatis; petiolo 2 cm. vel ultra longo; spicis, ut adsunt, 3 mm. crassis, 3.5 cm. longis; pedunculo 2.5 cm. longo; bracteis triangulari-subpeltatis, conferte pallido-fimbriatis; ovario subgloboso, stylo brevi; stigmatibus 3, rotundatis.

Shrub, 30 cm. tall; stem sparsely pubescent (?); leaves obovate or elliptic-obovate, apex acutish, base subequilateral and abruptly acute at the petiole, 7-12 cm. wide \times 12-19 cm. long, pinnately nerved below the upper third, the nerves about 6 on each side, with prominent cross-connecting-anastomosing nervules, sparsely villous above, the nerves beneath crisp- or appressed-pubescent, rather obscurely glandular-dotted, drying papery, translucent, finely pellucid-dotted; petiole up to 2 cm. or more long, vaginate toward the base (?); spikes as yet young, 3 mm. thick \times 3.5 cm. long; peduncle 2.5 cm. long, sparsely pubescent; bracts triangular-subpeltate, densely pale-fringed; ovary subglobose, stigmas 3, rounded, on a rather short, stout style; fruit not developed.

Known only from the one collection.

BOCAS DEL TORO: Fish Creek, Apr. 9, 1941, von Wedel 2187 (Herb. Missouri Bot. Gard., TYPE).



Fig. 1. *Piper crassinervium*
var. *tocotanum*

The type specimen is rather poor and fragmentary but it does not appear to agree with any other known species. The very small plants, obovate leaves, densely fringed bracts, and stylose ovaries are distinctive characters.

8. *Piper crassinervium* H.B.K. var. *tocotanum* (C.DC.) Yuncker, comb. nov.

Piper esserens (Miq.) C.DC. var. *tocotanum* C.DC.
in Ann. Conserv. & Jard. Bot. Genève 21:239.
1920.

Piper papyraceum Trel. in Contr. U. S. Nat. Herb.
26:31. 1927.

Piper novae-belgicae Trel. in Ann. Mo. Bot. Gard.
27:294. 1940.

An essentially glabrous shrub or small tree, 2-5 m. tall; upper internodes comparatively short but soon lengthening, glabrous; leaves ovate, 5-14 cm. wide \times 13-23 cm. long, apex acuminate, base rounded, obtuse or in large leaves sometimes shallowly cordate, equilateral or with one side slightly shorter, abruptly acute

at the petiole, pinnately nerved from below the middle, the nerves 4 or 5 on each side, prominent beneath, glabrous or at most only sparsely minutely puberulent along the nerves, drying firm, translucent; petiole about 15 mm. long, vaginate and narrowly winged to the middle or above; spikes 5-7 mm. thick \times 12-15 cm. long when mature; peduncle stout, 5-15 mm. long, pubescent; bracts rounded- or triangular-subpeltate, marginally fringed, zonately arranged; fruit rounded, glabrate, stigmas 3, recurved, on a rather short style.

Venezuela, Colombia, and Panama; the species Colombia and Ecuador.

CHIRIQUÍ: vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, alt. 1800-2000 m., Allen 1359, 1416; forests around El Boquete, alt. 1000-1300 m., Pittier 3023.

No significant difference has been found by means of which the Panamanian specimens can be distinguished from those from South America.

9. *Piper phytolaccaefolium* Opiz in Presl, Reliq. Haenk. 151. 1830.

Piper brevispicatum Opiz, loc. cit. 151, pl. 28. 1830.
Artanthe heterophylla Miq., Syst. Pip. 502. 1844.
Artanthe brevispicata Miq., loc. cit. 508. 1844.
Artanthe phytolaccaefolia Miq., loc. cit. 534. 1844.
Peltobryon phytolaccaefolium Presl, Epim. Bot. 224. 1849.
Piper singulare C.DC. in Jour. Bot. 4:161. 1866.
Piper amorphicarpum Trel. in Contr. U. S. Nat. Herb. 26:29. 1927.
Piper simulans Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:361. 1937.

A glandular-granular shrub, 1-2 m. tall, glabrous or obscurely and transiently puberulent; twigs rather slender; leaves lance- or oblong-elliptic, 3-6 cm. wide \times 10-13 cm. long, or occasionally up to 8 \times 19 cm., apex acuminate, base acute to cuneate, mostly equilateral, glandular-dotted, often strongly so, pinnately nerved throughout or some leaves from below the upper third, the nerves 4, or in large leaves 5-6 on each side, mostly scarcely ciliate; petiole 5-10 mm. long, vaginate at the base; spikes 5 mm. thick \times 2-4 cm. long; peduncle 5-20 mm. long, glabrate or very sparsely hirtellous; bracts triangular- or rounded-subpeltate, marginally fringed; fruit globose, stigmas 3, small, on a short subulate style.

Colombia, Ecuador, and Panama.

PANAMA: without definite locality, Née 363, 364, 367. BOCAS DEL TORO: Changuinola Valley, Dunlap 459. CHIRIQUÍ: Boquete District, Boquete, alt. 1140 m., Davidson 619; along Río Caldera, south of El Boquete, alt. 1250 m., Killip 3611.

No significant differences have been discovered between the Panamanian specimens cited here and those which have been studied from South America. Those from Panama, however, are, so far as seen, less conspicuously glandular-dotted than are those of South America. A specimen collected by Née without definite locality indicated has the leaves ciliate and with a few scattered long hairs on the upper surface.

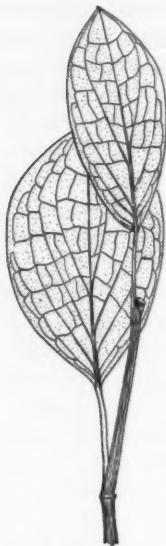
10. *Piper macropunctatum* Yuncker, sp. nov.

Fig. 2. *Piper macropunctatum*

Frutex, ca. 0.5 m. altus, dissite hirtulus; internodiis usque ad 6 cm. longis, obvie conferte glandulosis; foliis elliptico-ovobatis, apice obtusis vel abrupte brevi-acutis, basi inaequilateraliter acutis, latere altero ca. 2 mm. breviore, utrinque glabratibus vel subtus ad basem dissite pubescentibus, a medio laminae dorsum pinnatim venosis, venis utrinque 5, utrinque conferte glanduloso-punctatis, margine revolutis; petiolo 2-4 cm. cum 2 mm. longo; basi vaginato; bracteis triangulari-lunato-subpeltatis; ovario ovoido glanduloso, stylo brevi, crasso, subalato, stigmatibus parvis.

A small, essentially glabrous shrub, about 0.5 m. tall; stem unbranched, internodes up to 6 cm. long, strongly glandular-dotted; leaves elliptic-ovate, apex obtuse or abruptly short-acute, base inequilaterally acute, one side about 2 mm. shorter, 6-8.5 cm. wide \times 13-15 cm. long, glabrous on both sides or sparsely pubescent near the base beneath, pinnately nerved from the lower half, the nerves 5 on each side, with cross-connecting-anastomosing nervules, submarginally loop-connected, strongly glandular-dotted on both sides, drying rather thin, translucent, pellucid-dotted, revolute; petiole 2-4 cm. plus 2 mm. long, glabrous or sparsely pubescent, vaginate near the base; spikes 3 mm. thick \times 2.5 cm. or more long; bracts triangular-lunate-subpeltate, glabrous (?); ovary glandular, ovoid, with a short, stout, subulate style, stigmas small, sessile.

Known only from the type locality.

BOCAS DEL TORO: Pumpkin River, July 28, 1941, von Wedel 2561 (Herb. Missouri Bot. Gard., TYPE).

The small, simple, glabrous plants, strongly glandular-dotted with comparatively large dots, obovate, revolute leaves, and pointed ovary distinguish this species. The only spike present on the type specimen is fragmentary and young.

11. *Piper latibracteum* C.D.C. in Smiths. Misc. Coll. 71⁶:5. 1920.

A shrub, about 1 m. tall; flowering internodes moderately stout and short, glabrous; leaves broad-elliptic, apex gradually acute, base narrowed, obtuse or slightly cordulate, one side 1-2 mm. shorter, 11-14 cm. wide \times 20-24 cm. long, pinnately nerved below the upper third, the nerves 7-8 on each side, with intermediates and slender cross-connecting and anastomosing nervules, glabrous above, the nerves beneath puberulent, somewhat rugose, glandular-dotted, drying subglossy and green above, paler beneath, papery, translucent; petiole 15-20 plus 1-2 mm. long, vaginate and narrowly winged to the blade; spikes 8 mm. thick \times 2 cm. long, apiculate; peduncle stout, scarcely 10 mm. long; bracts triangular-lunate,

glabrous, or marginally papillate, pedicel broad, concave; ovary glabrous, stigmas 2, recurved, on a short, stout style.

Southern Panama.

DARIÉN: Boca de Pauarandó, Sambú River, alt. 20 m., Pittier 5588; Cañi-Cuasi Trail, Chepigana Dist., alt. 900 m., Terry & Terry 1441; alt. 1650 m., Terry & Terry 1581.

The numerous nerves, puberulent beneath, short, thick, apiculate spikes, and stylose ovaries distinguish this species.

12. *PIPER CANDELARIANUM* C.DC. in *Linnaea* 37:357. 1872.

Piper globosum C.DC. loc. cit. 340. 1872 not Poir. 1804.

Piper psilocladum C.DC. in *Bull. Soc. Bot. Belg.* 30¹:211. 1891.

Scandent shrub, glabrous; flowering internodes rather slender and short, red-granular; leaves lance-elliptic or the lower subovate, apex gradually acute, base sub-equally acute or one side slightly shorter than the other, 2.5–4 cm. wide \times 8–12 cm. long, pinnately nerved throughout, the nerves mostly 6–7 on each side, with rather obscure intermediates and cross-connecting nervules, drying thin but firm, translucent, prominently yellow- or red-glandular-dotted on both sides; petiole scarcely 1 cm. long, vaginate toward the base; spikes 4–8 mm. thick \times 1.5–2.5 cm. long, mucronate; peduncle slender, about 1 cm. long, eventually recurving; bracts triangular-subpeltate, sparingly very short-fringed on the upper margin; fruit rather large, globose, attenuate into a short, stout style, conspicuously glandular roughened, glabrous, stigmas 3.

Costa Rica and adjacent Panama.

BOCAS DEL TORO: Old Bank Island, vicinity of Chiriquí Lagoon, von Wedel 1994.

The short, thick styles, short spikes, glandular twigs, and pinnately nerved leaves are distinctive characters of this species. It resembles *P. cumaralense* of Colombia to some extent but differs because of its completely glabrous twigs and leaves and with the nerves of the leaves not submarginally loop-connected as in that species.

13. *PIPER MAGNANTHERUM* C.DC. in *Smiths. Misc. Coll.* 71⁶:16. 1920.

A glabrous, strongly red-glandular shrub (?); flowering internodes short and slender; leaves lance-elliptic-oblong, apex acuminate, base obliquely acute, one side 5–10 mm. shorter, 3.5–5 cm. wide \times 12–15 cm. long, pinnately nerved from the lower half, the nerves 4 or 5 on each side, or with additional lateral nerves to the upper fourth, with few cross-connecting nervules, rather loosely ciliate toward the apex, drying thin, translucent; petiole 5–10 plus 5–10 mm. long, or on lower leaves up to 2 cm., vaginate at the base; spikes as yet young, 2–3 mm. thick \times 1.5 cm. long, mucronate, peduncle 5–8 mm. long; bracts triangular-subpeltate, marginally pale-ciliate; ovary ovoid, narrowing into a short, stout style, stigmas 3, small, short.

Known only from the following locality.

DARIÉN: Cerro de Garagará, Sambú basin, southern Darién, alt. 500-974 m., Pittier 5666.

The densely red-glandular leaves, twigs, etc., strongly inequilateral base of the leaves, and stylose ovaries distinguish this species. It resembles *P. phytolaccaefolium* in many respects but differs because of the inequilaterally based leaves, and conspicuous red-glands.

14. *PIPER GARAGARANUM* C.DC. in Smiths. Misc. Coll. 71⁶:15. 1920.

A shrub; flowering internodes moderately slender, rather short, moderately to sparsely loosely villous; leaves lance-elliptic, apex sharp-acuminate, base equilateral and obtusish, or more commonly inequilateral and acute with one side about 2 mm. shorter, 4.5-7 cm. wide \times 13-17 cm. long, pinnately nerved from below the middle, the nerves 3-4 or 5 on each side, with rather open, cross-connecting-anastomosing nervules, loosely long-villous, especially along the nerves beneath, somewhat long-ciliate, glandular-dotted beneath, drying rather thin and papery, translucent; petiole 20 plus 2 mm. long on lower leaves and vaginate-winged to about the middle, reduced upward, villous; spikes 3 mm. thick \times 15-18 mm. long; peduncle about 5 mm. long, villous; bracts small, concave, short-ciliate along the concave margin; ovary ovoid, narrowing into a short, stout style, stigmas rather short, recurved.

Darién Province.

DARIÉN: foothills of Garagará, Sambú basin, alt. 30-500 m., Pittier 5618; Chepigana Dist., Caña-Cuasi Trail (Camp 2), alt. 600 m., Terry & Terry 1432.

The short spikes, and thinly long-villous and ciliate leaves distinguish this species.

15. *PIPER PUBISTIPULUM* C.DC. in Smiths. Misc. Coll. 71⁶:5. 1920.

Piper pubistipulum var. *eustylolum* Trel. in Contr. U. S. Nat. Herb. 26:28. 1927.

A small shrub, 1 m. tall; upper internodes short, densely retrorsely hirsute; leaves oblong-lanceolate, apex gradually rather long-acuminate, base somewhat narrowed, cordulate, one side 2-3 mm. shorter, glabrous above except for the midrib which is pubescent near the base, pubescent beneath with the nerves hirsute, 5-6 cm. wide \times 15-19 cm. long, pinnately nerved from the lower half, the nerves 4 on each side, raised beneath, with cross-connecting and anastomosing nervules, sparsely glandular-dotted beneath, smooth or subrugose, drying firm, translucent; petiole stout, 6-8 plus 2 mm. long, densely hairy, deeply vaginate to the blade; spikes 3-4 mm. thick \times 2 cm. long, mucronate; peduncle 5 mm. long, hirsute; bracts triangular-lunate, glabrous, pedicel broad, cupulate; ovary narrowed abruptly into a short, thick style, stigmas 2, recurved.

Central Panama.

CANAL ZONE: Barro Colorado Island, Gatún Lake, Standley 31364; hills around the Agua Clara Reservoir, near Gatún, alt. 20-30 m., Pittier 2661. PANAMÁ: Indio, Miller 2078.

The densely pubescent stems, oblong-lanceolate leaves, pubescent beneath and with somewhat inequilateral, cordulate bases, short spikes, and stylose fruits distinguish this species. The spike on the type of var. *eustylulosum* is so young that it is not possible to determine the style character. The specimen agrees so well otherwise that it is believed that it is same as the species.

16. *PIPER COLON-INSULAE* Trel. in Ann. Mo. Bot. Gard. 27:290. 1940.

A shrub, 2 m. tall; upper internodes relatively slender, densely dingy-villous; leaves elliptic, apex acute or short-acuminate, base inequilaterally cordulate, margins subequal at the petiole, 5–8.5 cm. wide \times 13–16 cm. long, glabrous above or the midrib with a few hairs at the very base, villous beneath, at least along the nerves, pinnately nerved below the upper third, the nerves about 5 on each side, with numerous cross-connecting-anastomosing nervules, drying papery, translucent; petiole 1–1.5 cm. long, densely dingy-villous, vaginate to the blade; spikes 5 mm. thick \times 2.5–3 cm. long; peduncle 8 mm. long, subhirsute; bracts narrowly triangular-lunate, glabrous; fruit subquadangular-oblong, stigmas on a very short style.

Known only from the following locality.

BOCAS DEL TORO: Isla de Colón, alt. 25–75 m., Woodson, Allen & Seibert 1934.

17. *PIPER distigmatum* Yuncker, sp. nov.

Frutex (?) vel arbuscula glabrus 2–3 m. altus; internodiis floriferis modice brevibus gracilibusque; foliis late ellipticis, apice abrupte breviter acuminatis, basi obtusis vel ad petiolum abrupte subacute, rugosis, infra medium pinnatim venosis, venis utrinque 5, subtus prominentibus, rubro-glanduloso-punctatis; petiolo 1.5–2.5 cm. longo, ad laminam vaginato; spicis 5–8 mm. crassis, 1.5–2.2 cm. longis apiculatis; pedunculo ca. 1 cm. longo; bracteis triangulari-lunatis glabratibus; drupa subglobosa, stigmatibus binis ligulatis recurvis, stylo sat longo crasso subulato fultis.

A glabrous shrub (?) or small tree, 2–3 m. tall; flowering internodes moderately short and slender; leaves broadly elliptic, apex abruptly short-acuminate, base rounded, obtuse or abruptly subacute at the petiole, 8–9.5 cm. wide \times 14–17 cm. long, rugose, pinnately nerved from below the middle, the nerves 5 on each side, prominent beneath, not branched but with slender cross-connecting and anastomosing nervules, red-glandular-dotted, especially on the lower surface, drying firm, translucent; petiole 1.5–2.5

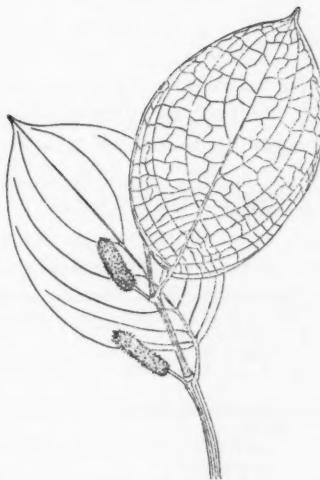


Fig. 3. *Piper distigmatum*

cm. long, vaginate to the blade; spikes 5-8 mm. thick \times 1.5-2.2 cm. long, apiculate; peduncle about 1 cm. long; bracts triangular-lunate, glabrous, pedicel broad, curved; fruit subglobose, stigmas 2, ligulate, recurved, on a rather long, stoutish, subulate style.

Known only from the type locality.

CHIRIQUI: Boquete Region, Cerro Horqueta, cloud forest, alt. 1950 m., April 17, 1940, von Hagen & von Hagen 2009 (Herb. Missouri Bot. Gard., TYPE); April 27, 1940, von Hagen & von Hagen 2058.

The broadly elliptic, somewhat rugose leaves, and bistigmatic, rather long-styled fruit distinguish this species. It differs from *P. Davidsonii* because of the shape of the larger, rugose, more abruptly acuminate leaves, 5-nerved on each side.

18. *PIPER Davidsonii* Yuncker, sp. nov.

Frutex parvus glaber; internodiis superis sat brevibus gracilibusque; foliis ovatis vel elliptico-ovatis, apice acuminatis, basi rotundatis ad petiolum abrupte acutis, infra medium pinnatim venosis, venis utrinque 4, manifeste rubro-glandulosopunctatis; petiolo ca. 1.5 cm. longo, ad laminam vaginato; spicis, ut adsunt, 5 mm. crassis, 1 cm. longis; pedunculo 1 cm. longo; bracteis triangulari-subpeltatis, glabratis; ovario globoso (?), stigmatibus 2, stylo longo fultis.

A small, glabrous shrub, 1-2 m. tall; upper internodes rather short and slender; leaves ovate or elliptic-ovate, apex acuminate, base rounded, abruptly short-acute at the petiole, 6-7.5 cm. wide \times 14-16 cm. long, pinnately nerved from below the middle, the nerves 4 on each side or with a very slender fifth nerve at the base in large leaves, strongly red-glandular-dotted, especially beneath, green above, pale beneath, drying firm, translucent; petiole about 1.5 cm. long, vaginate to the blade; spikes, as represented, 5 mm. thick \times 1 cm. long; peduncle 1 cm. long; bracts triangular-subpeltate, glabrous, the pedicel broad, concave, papillate; ovary globose (?), stigmas 2, on an elongated style.

Known only from the type locality.

CHIRIQUI: Bajo Chorro, Boquete District, alt. 1800 m., Feb. 15, 1938, M. E. Davidson 285 (Herb. Missouri Bot. Gard., TYPE).

II. KEY TO SPECIES WITH PALMATELY NERVED LEAVES

(The nerves may coalesce within the lowermost 5 mm.)

- a. Fruit papillate, with a prominent, glabrous, apical disc..... 19. *P. RETICULATUM*
- aa. Fruit lacking any evident apical disc.
 - b. Leaf base cordate.
 - c. Leaves 9- to 11-nerved..... 20. *P. MARGINATUM*
 - cc. Leaves 5-nerved..... 21. *P. ARISTOLOCHIAE-FOLIUM*
 - bb. Leaf base rounded or narrowed, scarcely cordate, leaves more or less elliptic.
 - c. Leaf base inequilateral with one side about 2 mm. shorter; flowers approximated.
 - d. Petiole vagina margin glabrous; leaves lanceolate, 3-nerved..... 22. *P. HUMORIGAUDENS*
 - dd. Petiole vagina margin ciliate; leaves lance-elliptic, 5-nerved..... 23. *P. CONVERSUM*
 - cc. Leaf base essentially equilateral, 5- to 7-nerved.
 - d. Flowers distant; bracts glabrous..... 24. *P. PINOGANENSE*
 - dd. Flowers more compact; bracts papillate-pilose..... 25. *P. MEDIUM*

19. *Piper reticulatum* L. Sp. Pl. 1:29. 1753.

Piper smilacifolium H.B.K. Nov. Gen. & Sp. 1:56. 1815.
Piper latum H.B.K. loc. cit. 57. 1815.
Enckea smilacifolia Kunth, in Linnaea 13:605. 1839.
Enckea lata Kunth, loc. cit. 606. 1839.
Enckea reticulata Miq. Syst. Pip. 365. 1843.
Macropiper latum Presl, Epim. Bot. 223. 1849.
Piper Duchassaingii C.D.C. in DC. Prodr. 16¹:251. 1869.

A glabrous shrub or small tree up to 4-6 m. tall; branches slender, nodose; leaves elliptic, elliptic-ovate, or broadly ovate, 8-15 cm. wide \times 15-25 cm. long or occasionally up to 25 cm. wide \times 30 cm. long, apex acuminate, base essentially equilateral, more or less acute, truncated, or in large leaves shallowly cordate, palmately 5- to 7-nerved, or larger leaves 9-nerved, the nerves prominent beneath, reticulate-veiny with rather prominent cross-connecting nervules, drying firm and chartaceous; petiole 1-2 cm. long, glabrate or very obscurely puberulent-papillate, grooved above, vaginate near the base; spikes 5-6 mm. thick and up to 10 or 12 or occasionally 15 cm. long when mature; peduncle slender, 1-2 cm. long; rachis with membranous, fimbriated ridges; bracts peltately dilated upward, pedicel and margin bearded; stamens 4; fruit obovoid, somewhat 4-sided, papillate, with an apical, smooth, disc-like area, stigmas 3 or 4, rounded.

West Indies and on the mainland from Central America through northern South America.

BOCAS DEL TORO: Lower Changuinola River, *Stork* 50. CHIRIQUI: Progreso, *Cooper* & *Slater* 185. CANAL ZONE: along Caño Quebrado, *Pittier* 6986; around Gamboa, alt. 40-80 m., *Pittier* 3778; between Gorgona and Gatún, alt. 10-50 m., *Pittier* 2279; near Gatún, *Standley* 27201; Mamei Hill, alt. 20-90 m., *Pittier* 3811; near Summit, *Standley* 25728; Cerro Gordo, near Culebra, *Standley* 26008; Río Pedro Miquel, near East Paraiso, *Standley* 29969; vicinity of Fort Sherman, *Standley* 30959; Barro Colorado Island, *Standley* 31267; *Miller* 2075; Matachín, *Kuntze* 1918; Obispo, *Standley* 31726; vicinity of Gatuncillo, *Piper* 5603, 5620; Río Agua Salud, near Frijoles, *Piper* 5859, 5860; Empire, *Miller* 1867; Madden Dam Road, *Miller* 1800; along Río Chagres between Gamboa and Alahuela, alt. 30-60 m., *Allen* 956. COLÓN: between France Field and Catival, *Standley* 30338; along Río Fató, alt. 10-100 m., *Pittier* 3872, 3882; Fató, *Pittier* 3842. PANAMÁ: Río Tapia, *Standley* 26160, 28035, 28241; near Tapia River, Juan Diaz region, *Maxon* & *Harvey* 6650, 6708; Juan Diaz, *Standley* 30548; Río Tecumen, *Standley* 29363. DARIÉN: along Sambú River, *Pittier* 5570.

The large, glabrous, rather veiny leaves, comparatively short spikes, and especially the prominent glabrous disc at the top of the papillate fruit, characterize this species. There is a wide variation in the size of the leaves.

20. *Piper marginatum* Jacq. Icon. Pl. Rar. 2:2, pl. 215. 1786.

Piper decumanum Aubl. Pl. Guian. Fr. 1:21. 1775, not L. 1760, nor *Miller* 1763.
Piper caudatum Vahl, Eclog. Am. 1:3. 1796.
Piper alare Ham. Prodr. Pl. Ind. Occ. 3. 1825.
Schilleria caudata Kunth, in Linnaea 13:716. 1839.
Schilleria marginata Kunth, loc. cit. 718. 1839.
Artanthe caudata Miq. Syst. Pip. 380. 1843.
Artanthe marginata Miq. loc. cit. 381. 1843.
Artanthe alaris Miq. loc. cit. 406. 1843.

Piper regressum Anders. in Miq. loc. cit. 380. 1843, as synonym.

Piper san-joseanum C.DC. in Linnaea 37:351. 1872.

Piper san-joseanum var. *chiriquinum* Trel. in Ann. Mo. Bot. Gard. 25:826. 1938.

Piper san-joseanum var. *kobense* Trel. loc. cit. 27:297. 1940.

Piper san-joseanum var. *panamense* Trel. loc. cit. 1940.

Piper san-joseanum var. *tabogense* Trel. loc. cit. 1940.



Fig. 4. *P. marginatum*

occasionally 20 cm. long; peduncle about 10 mm. long; bracts transversely triangular-peltate, marginally fringed; fruit smooth, obpyramidal, angular; stigmas 3, linear, sessile.

West Indies, on the mainland of Central America, and southward to Brazil and Ecuador.

PANAMA: without indication of locality, Née 300, 387. PROVINCE (?): Santa Rita Trail, Cowell 117, 122. CHIRIQUI: between Rio Tabasara and Rio Tinta, Woodson, Seibert & Allen 416. VERAGUAS: Isla de Uva, Contreras group, Pittier 5112. COCLÉ: El Valle, Miller 1812. CANAL ZONE: Monkey Hill above Colón, Lebmann XLVI; New Limón, Stevens 1015; Culebra, Stevens 927; Fort Kobe road, Woodson, Allen & Seibert 1423; western slope of Ancón Hill, vicinity of Balboa, alt. 20-75 m., Seibert 388; Ancón Hill, Killip 3041, 12087; Standley 26326; Balboa, Standley 25600; between Frijoles and Monte Lirio, alt. 30 m., Killip 12116; Frijoles, Standley 27627; Empire, Miller 1862; Juan Mina, *Piper* 5696, 5698; near old Fort Lorenzo, mouth of Rio Chagres, *Piper* 5898, 5917, 5962; Culebra, alt. 50-150 m., Pittier 2146; Cerro Gordo, near Culebra, alt. 50-290 m., Pittier 3737; Standley 25964; Corozal, Stevens 118; Agua Clara Reservoir, Stevens 546; near Summit, Standley 25751, 26938; near Gatún, Standley 27247, 27288; Gamboa, Standley 28334, 28536; near Fort Randolph, Standley 28655; vicinity of Fort Sherman, Standley 30942; Stevens 267; Darién Station, Standley 31557; Barro Colorado Island, Standley 40832; Kenoyer 599. COLÓN: between Fató and Playa de Damas, Pittier 3934; vicinity of Santa Isabel, Pittier 4176. PANAMÁ: Gorgona Beach, Woodson, Allen & Seibert 1690; Taboga

Island, alt. 0-186 m., *Woodson, Allen & Seibert 1531*; *Killip 3165, 3195; Miller 1848; Pittier 3553; Standley 27044, 27057, 27847; Camino de la Granja, Bro. *Heriberto 166*; Bella Vista, *Killip 12012; Standley 25332; Madden Lake, Miller 2077; near Punta Paitilla, Standley 26274; near big swamp, east of Río Tecumen, Standley 26599; along Corozal road, near Panamá, Standley 26834; Río Tapia, Standley 28207; between Fort Clayton and Corozal, Standley 29214; Río Tecumen, Standley 29482; Juan Díaz, Standley 30521; between Las Sabanas and Matias Hernández, Standley 31835.* HERRERA: *Pesé*, alt. 50 m., *Allen 801*. DARIÉN: around Garachiné, *Pittier 5512*.*

KEY TO THE VARIETIES OF *P. marginatum*

- a. Sinus wide, open, lobes more or less divergent.
- b. Leaves not pilose above, the nerves glabrous or puberulent.
 - c. Nerves scarcely puberulent..... 20. *P. marginatum*
 - cc. Nerves puberulent, at least above..... 20a. var. *anisatum*
 - bb. Leaves appressed-pilose above, at least toward the apex; nerves beneath pubescent..... 20b. var. *catalpaefolium*
- aa. Sinus closed or nearly so, lobes approximated or overlapping..... 20c. var. *clausum*

20a. *PIPER marginatum* var. *anisatum* (H.B.K.) C.DC. in *Urb. Symb. Ant.* 3:172. 1902.

Piper anisatum H.B.K. Nov. Gen. & Sp. 1:58. 1815.

Piper san-joseanum var. *remediosense* Trel. in *Ann. Mo. Bot. Gard.* 27:297. 1940.

The nerves puberulent or hirtellous, at least on the upper surface.

Occurs with the species.

CHIRIQUÍ: Río Chiriquí to Remedios, alt. 15-50 m., *Woodson, Allen & Seibert 1191*. PANAMÁ: Perlas Archipelago, San José Island, *Johnston 319, 472*; Saboga Island, *Miller 1953*; along Chararé River, near Chepo, alt. 50-100 m., *Pittier 4708*. DARIÉN: trail between Pinogana and Yavisa, alt. 15 m., *Allen 260*.

20b. *PIPER marginatum* var. *catalpaefolium* (H.B.K.) C.DC. in DC. *Prodr. 16¹:246. 1869.*

Piper catalpaefolium H.B.K. Nov. Gen. & Sp. 1:58. 1815.

Schilleria catalpaefolia Kunth, in *Linnaea* 13:718. 1839.

Artanthe catalpaefolia Miq. *Versl. en Medel. Kon. Nederl. Inst.* 1842:197. 1843.

Piper pseudomarginatum C.DC. in *Bull. Herb. Boiss.* 6:492. 1898.

Leaves appressed-pilose above, at least toward the apex, and pubescent along the nerves beneath.

Occurs with the species.

CANAL ZONE: Corozal, *Stevens 63*. PANAMÁ: Perlas Archipelago, Trapeche Island, *Miller 1907*. DARIÉN: vicinity of Boca de Cupe, alt. 40 m., *Allen 869*.

20c. *PIPER marginatum* var. *clausum* Yuncker, var. nov.

Foliis suborbicularibus, basi profunde cordatis, sinu angustato, lobis approximatis vel invicem obtegentibus.

Leaves suborbicular, base deeply cordate with narrow sinus, the lobes approximated or overlapping.

Central Panama.

CANAL ZONE: Empire, March 5, 1937, *Miller 1861* (U. S. Nat. Herb., TYPE); vicinity of Salamanca Hydrographic Station, Río Pequeni, alt. 80 m., July 28-29, 1938, *Woodson, Allen & Seibert 1608*—this specimen shows somewhat more open sinuses than does the type.

21. *PIPER aristolochiaefolium* (Trel.) Yuncker, comb. nov.*Piper san-joseanum* var. *aristolochiaefolium* Trel. in Contr. U. S. Nat. Herb. 26:22. 1927.

A shrub, 1.5-2 m. tall, twigs somewhat zig-zag, granular-papillate, moderately slender; leaves bullate and dark green when growing, rather narrowly ovate, apex long-acuminate, base deeply cordate, sinus open, obtuse, with parallel margins, 8-9 cm. wide \times 15 cm. long, palmately 5-nerved, the innermost laterals not continuing to the apex, the midrib strongly branched upward, the nerves and cross-connecting-anastomosing nervules prominent beneath, the innermost pair of laterals entirely free from the midrib, with scattered, soft, white hairs above, paler and with the nerves granulate-papillate or subhirtellous beneath, ciliate, the hairs restricted to a single marginal row, pale-yellow-glandular-dotted beneath, drying thin, translucent; petiole 3-4 cm. long, vaginate to about the middle, scarcely winged, granulate-subhirtellous. No inflorescence present.

Known only from the type locality.

CANAL ZONE: wet forest, hills north of Frijoles, "scarce," Dec. 19, 1923, Standley 27524 (U. S. Nat. Herb., TYPE).

The specimen on which this species is based is sterile but the vegetative characters are believed to be sufficiently different from *P. marginatum* to warrant specific rank. It differs from that species chiefly because of the 5-nerved leaves, the midrib strongly branched upward, the lateral nerves not continuing to the apex, the ciliation restricted to a single row of marginal hairs, and the shape of the basal sinus.

22. *PIPER HUMORIGAUDENS* Trel. in Ann. Mo. Bot. Gard. 27:293. 1940.

A branching, nodose, glabrous shrub, 2 m. tall; upper internodes short and slender, finely ribbed; leaves lanceolate, apex rather gradually blunt-acuminate, base inequilaterally narrowed downward, one side about 2 mm. shorter at the petiole, the shorter side acute, the longer side rounded, subacute, 2.5-3 cm. wide \times 8-11 cm. long, 3-nerved, the nerves unevenly coalescing within the lowermost 5 mm., salient beneath, cross-connecting and anastomosing nervules very slender, drying rather firm, subtranslucent; petiole scarcely 5 plus 2 mm. long, vaginate near the base; spikes 3 mm. thick \times 4-5 cm. long; peduncle 1-1.5 cm. long; rachis ridges fimbriate; bracts small, subcucullate, marginally short-fringed; fruit somewhat granular, depressed-subglobose, laterally compressed; stigmas sessile.

Known only from the following locality.

COCLÉ: wet north rim, El Valle, alt. 80-100 m., May 21, 1939, Allen 1833.

23. *PIPER CONVERSUM* Trel. in Ann. Mo. Bot. Gard. 27:290. 1940.

Subarborescent, 2 m. tall; young branches nodose, very slender, internodes short, finely striate, obscurely and minutely hirtellous glabrescent; leaves lance-elliptic, apex caudately acuminate, base about 2 mm. shorter on one side, acute, 3-4.5 cm. wide \times 10-12 cm. long, palmately 5-nerved with the outermost pair of nerves delicate and loop-connected with cross-connecting nerves upward, the innermost

pair of lateral nerves slightly coalescent with the midrib at the base, prominent beneath, drying thin, translucent; petiole about 3 mm. plus 2 mm. long, obscurely hirtellous, vaginate toward the base, the margin of the vagina ciliate; spikes as yet young, 2 mm. wide \times 2.5 cm. long; peduncle 5 mm. long, glabrous; bracts inflexed-subpetiolate, ciliate; ovary ovoid, stigmas apical.

Known only from the following collection.

CHIRIQUI: Llanos del Volcán, alt. about 1300 m., *Allen 1550*.

This species closely resembles *P. humorigaudens* but differs because of the shape of the 5-nerved, more attenuately acuminate leaves, subhirtellous twigs and petioles, and ciliate margins of the petiole vaginal groove.

24. *PIPER PINOGANENSE* Trel. in Contr. U. S. Nat. Herb. 26:22. 1927.

Piper tabasaranum Trel. in Ann. Mo. Bot. Gard. 25:827. 1938.

Piper salamancaicum Trel. loc. cit. 27:296. 1940.

A shrub or small tree, 1.5-4 m. tall, nodose; internodes slender, rather short, minutely and transiently puberulent, finely ribbed; leaves elliptic, apex caudately blunt-acuminate, base rounded but subacute at the petiole, or narrowed and acute, 3-5.5 cm. wide \times 8-12 cm. long, palmately 5-nerved, the nerves salient on both sides, the innermost pair of laterals coalescing with the midrib within the lowermost 5 mm., with numerous, fine, cross-connecting and anastomosing nervules, drying light green, firm, chartaceous, glossy, translucent; petiole scarcely 5 mm. long, granular-puberulent, channelled above, drying wrinkled, vaginate toward the base; spikes 3-4.5 cm. long, loosely flowered; peduncle scarcely 1 cm. long, obscurely puberulent; bracts very small, concave, glabrous; fruit ovoid, smooth or papillate; stigmas 3 or 4, sessile.

Panama.

CHIRIQUI: banks of lower Río Tabasará, *Woodson, Allen & Seibert 440*. CANAL ZONE: vicinity of Salamanca Hydrographic Station, Río Pequení, alt. 80 m., *Woodson, Allen & Seibert 1590*. DARIÉN: around Pinogana, *Pittier 6656*.

25. *PIPER MEDIUM* Jacq. Icon. Pl. Rar. 1:2. 1781.

Piper plantagineum Lam. Illustr. Encyc. Meth. 1:80. 1791.

Piper saururoides Ham. Prodri. Pl. Ind. Occ. 3. 1825.

Piper reticulatum Vell. Fl. Flum. 1: pl. 61. 1827, not L. 1753.

Piper syringaefolium Balbis ex Kunth, in Linnaea 13:599. 1839.

Piper orthostachyum Kunth, loc. cit. 602. 1839.

Enckea plantaginea Kunth, loc. cit. 599. 1839.

Enckea orthostachys Kunth, loc. cit. 601. 1839.

Enckea Sieberi Miq. Syst. Pip. 358. 1843.

Piper victorianum C.DC. in Jour. Bot. 4:218. 1866.

Piper tigerianum C.DC. loc. cit. 300. 1866.

Piper Sieberi C.DC. in DC. Prodri. 16¹:248. 1869.

A shrub; stems and branches glabrous or slightly puberulent when young; leaves lance- to round-elliptic or subrhombically obovate, 3.5-6 cm. wide \times 8-11 cm. long, or rarely occasional leaves up to 10 \times 14 cm., apex acuminate, base sometimes suboblique, acute or somewhat rounded, more or less subauriculate at

the very base, or lowermost somewhat cordate, glabrous or puberulent along the nerves beneath, palmately 5- to 7-nerved, reticulate-nervulose, drying membranous and minutely pellucid-dotted; petiole 5-10 mm. long, vaginate near the base, puberulent; spikes 4-5 mm. thick \times 6-7 cm. long; peduncle 10-15 mm. long, puberulent or glabrous; rachis puberulent; bracts obovate-concave, somewhat papillate-pilose; fruit ovoid, minutely papillate or glabrous; stigmas 3 or 4, rounded, sessile.

West Indies, Central and South America.

CANAL ZONE: forest along banks of Quebrada Fea, Q. Pura and Cañon of Río Chagres, alt. 70-100 m., Dodge & Hunter 17404. CHIRIQUI: Cerro Galera Chorcha, vicinity of Gualaca, alt. 300 m., Allen 5060.

This species closely resembles *P. pinoganense* but differs primarily because of its more membranous leaves and hairy rachis and floral bracts.

III. KEY TO SPECIES WITH LEAVES MOSTLY 20 CM. OR MORE LONG AND MORE OR LESS LOBED AT THE BASE

(The base may be only slightly lobed but none are rounded or acute; the petiole mostly vaginat-winged to the middle or above.)

- a. Leaves rugose or bullate.
 - b. Leaves scabrid..... 41. *P. PERACUMINATUM*
 - bb. Leaves not scabrid.
 - c. Leaves loosely long-villous; peduncle 1-2 cm. long..... 26. *P. PARTITICUSPE*
 - cc. Leaves hirtellous to pubescent; peduncle 1-2.5 cm. or more long.... 27. *P. COOPERI*
 - aa. Leaves scarcely rugose or bullate.
 - b. Leaves and stems glabrous..... 28. *P. HASTULARUM*
 - bb. Leaves and/or stems pubescent.
 - c. Leaves scabrous..... 41. *P. PERACUMINATUM*
 - cc. Leaves not scabrous.
 - d. Leaf margin densely ciliolate, drying thin; spikes scarcely 5 mm. thick, yellow when dry..... 29. *P. AURITUM*
 - dd. Leaf margin glabrous or essentially so.
 - e. Young twigs, nodes and/or petioles and midrib beneath more or less fleshy-warty..... 30. *P. IMPERIALE*
 - ee. Not fleshy-warty.
 - f. Stems matted brown-hairy, leaves 5- to 7-nerved.
 - g. Leaves acute, basal sinus wide, essentially glabrous above.... 31. *P. TARDENS*
 - gg. Leaves acuminate; basal sinus narrow, nerves pubescent above..... 32. *P. CAMPANUM*
 - ff. Stems glabrous; leaves mostly 7- to 9-nerved.
 - g. Leaves glabrous above; petiole vaginate below the middle; bracts glabrate..... 33. *P. CARRILLOANUM*
 - gg. Leaves more or less hairy above; petiole vaginate to the blade; bracts fringed..... 34. *P. PITTIERI*

26. *PIPER PARTITICUSPE* Trel. in Ann. Mo. Bot. Gard. 27:294. 1940.

Suffruticose, 3 m. tall; internodes comparatively slender and elongate, for a time crisp-villous; leaves round-ovate, apex falcately acuminate, base inequilaterally cordate with one side surpassing the petiole, sinus open, 15-28 cm. wide \times 20-35 cm. long, pinnately nerved from the lower half, the nerves 6-8 on each side, with prominent cross-connecting and anastomosing nervules, venose-bullulate with 2-4

points to each cusp, the cusp points and the midrib near the base above long-villous, the nerves beneath loosely long-villous, drying firm, translucent; petiole 3-4 cm. long, densely villous; spikes 5 mm. thick \times 15 cm. long; peduncle 1-2 cm. long, loosely villous; bracts triangular-subpeltate, slightly ciliate; fruit small, subtrigonous, glabrous; stigmas small, sessile.

Known only from the one locality.

COCLÉ: vicinity of El Valle, alt. 600-1000 m., Allen 1195.

The villous, round-ovate leaves with multipointed, villous, bullulate elevations characterize this species.

27. *Piper Cooperi* Yuncker, sp. nov.

Frutex vel arbuscula, 5 m. altus; internodiis floriferis sat crassiusculis elongatisque conferte crispe-pubescentibus; foliis elliptico-subovatis rugosis, apice breviter subacuminatis, basi oblique cordatis, latere longiore petiolum excedente, infra medium pinnatim venosis, venis utrinque 6-7, laminae facie supra hirtella infra pubescente (ad venas quam maxime); petiolo 4-5 cm. longo, ad medium vel ultra vaginato-alato, conferte crispe pubescente; spicis immaturis 3 mm. crassis, 6 cm. longis; pedunculo 2.5-4 cm. longo, pubescente; bracteis rotundato-subpeltatis, atro-pubescentibus.

A shrub or small tree, 5 m. tall; stem 8 cm. thick, with clustered basal shoots; flowering internodes moderately stout and elongated, matted-crisp-pubescent; leaves elliptic-subovate, apex shortly subacuminate, base obliquely cordate, the longer lobe surpassing the petiole, 15-20 cm. wide \times 16-30 cm. long, pinnately nerved from the lower half, the nerves 6 or 7 on each side, with cross-connecting and anastomosing nervules, hirtellous above, at least along the nerves, pubescent beneath, the nerves densely so, bullate, drying dark, firm, opaque; petiole 4-5 cm. long, vaginately-winged to the middle or above, densely crisp-pubescent; spikes as yet young, 3 mm. thick \times 6 cm. long; peduncle 2.5-4 cm. long, pubescent; bracts round-subpeltate, dingy-hairy.

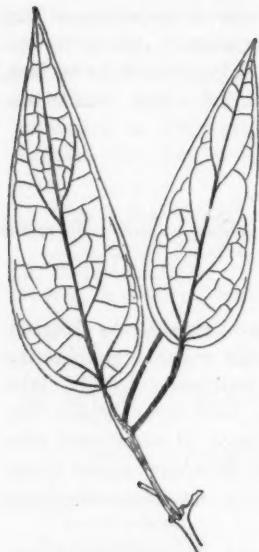
Known only from the type locality.

BOCAS DEL TORO: vicinity of Almirante, Daytona Farm, Jan.-Mar. 1928, G. Proctor Cooper 374 (U. S. Nat. Herb., TYPE).

This species differs from *P. partiticuspe*, which it resembles somewhat, because of the character of the pubescence, longer peduncles, pubescent bracts, etc.

28. *Piper hastularum* Yuncker, sp. nov.

Frutex primo intuitu glaber, ligno molli, 1-3 m. altus; internodiis floriferis elongatis crassiusculisque; foliis lanceolato-ovatis vel late lanceolatis, 6-11 cm. latis, 22-29 cm. longis, apice sensim acutis acuminatisve, basi oblique inaequilateralibus, ad petiolum utrinque obtusis vel latere altero obtuso acutove ad petiolum 3-10 mm. breviore, caetero rotundato-obtuso subcordatove, a tertio supero pinnatim venosis, venis utrinque 4-5, venulisque submarginalibus gracilibus puberulis, subtus prominentibus trabibus anastomosantibus manifestis, arctius revolutis,

Fig. 5. *Piper bastularum*

beneath; petiole 20–25 plus 3–10 mm. long, strongly vaginate-winged to the blade; spikes 3–4 mm. thick \times 13 cm. long; peduncle slender, about 1–2 cm. long; bracts narrowly triangular- or lunate-subpeltate, smooth or papillate, the pedicel broad, concave, glabrous or ciliate; fruit truncate-subglobose, glabrous; stigmas sessile.

Western Colombia and Panama.

COLOMBIA: CHOCÓ: Bahía Solano, dense forest along Quebrada Jellita, alt. 50–100 m., Feb. 22, 1939, Killip & García 33568 (U. S. Nat. Herb., TYPE).

PANAMÁ: BOCAS DEL TORO: Old Bank Island, von Wedel 1934. COCLÉ: El Valle de Antón, along Río Indio Trail, alt. 500–700 m., Hunter & Allen 316. DARIÉN: Chepigana District, Caña-Cuasi Trail (Camp 2), alt. 1200 m., March 10, 1940, Terry & Terry 1461.

The lanceolate leaves and submarginal puberulent nervules distinguish this species.

29. *PIPER AURITUM* H.B.K. Nov. Gen. & Sp. 1:54. 1815.

Schilleria aurita Kunth, in Linnaea 13:713. 1839.

Artanthe aurita Miq. Syst. Pip. 400. 1844.

Artanthe Seemanniana Miq. in Seem. Bot. Voy. Herald, 199, pl. 39. 1854, not *Piper Seemannianum* C.DC.

Piper auritum var. *amplifolium* C.DC. in DC. Prod. 16¹:321. 1869.

Piper auritum var. *Seemannianum* (Miq.) Trel. in Contr. U. S. Nat. Herb. 26:40. 1927.

Piper beraldii Trel. in Ann. Mo. Bot. Gard. 27:292. 1940.

Piper beraldii var. *amplius* Trel. loc. cit. 1940.

Piper heraldi var. *cocleanum* Trel. loc. cit. 1940.
Piper Alstoni Trel. loc. cit. 286. 1940.

A small, soft-wooded, commonly more or less aromatic tree, 3–6 m. tall, often occurring in clumps; flowering internodes moderately slender and long, striate, often drying black, glabrate or sometimes slightly pubescent; leaves ovate, oblong- or elliptic-ovate, 12–20 cm. wide \times 20–30 cm. long, or occasionally up to 25 \times 40 cm. or more, apex acute or short-acuminate, base deeply cordate with one side 1–2 cm. longer at the petiole and with the lower lobe longer, sinus rounded to the petiole, the midrib with 3 or 4 upcurved branches from below the upper third and 3 or 4 branches from the base, rather thinly short-hairy above at least along the nerves, more densely so beneath, densely white-ciliolate throughout, drying thin, translucent; petiole 4–9 plus 1–2 cm. long, more or less pubescent or glabrate, vaginately-winged to the blade; spikes creamy or light-yellow when dry, 3–5 mm. thick \times 10–25 cm. long; peduncle slender, 2–8 cm. long, glabrate, often black when dry; bracts round- or triangular-subpeltate, marginally fringed; fruit small, glabrate, obpyramidal-trigonous; stigmas 3, sessile.

West Indies and on the mainland from Mexico through Central America and northern South America.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 403; Laguna de Chiriquí, *Hart* 126; vicinity of Nieveleta, alt. 0–50 m., *Woodson*, *Allen* & *Seibert* 1813; vicinity of Chiriquí Lagoon, *von Wedel* 1194. CHIRIQUÍ: Finca Lérida to Boquete, alt. 1300–1700 m., *Woodson*, *Allen* & *Seibert* 1095; Cerro de la Plata, near San Felix, alt. 120–150 m., *Pittier* 5159; vicinity of David, alt. 30–80 m., *Pittier* 2829. COCLÉ: Penonomé, *Williams* 434; north rim of El Valle, *Alston* & *Allen* 1842; vicinity of El Valle, alt. 600–1000 m., *Allen* 1192. CANAL ZONE: Barro Colorado Island, *Bailey* & *Bailey* 27; *Bangham* 590; Monkey Hill, *Lebmann* 1004; *Cowell* 22; between Chagres Batteries and Fort San Lorenzo, Fort Sherman Military Reservation, *Maxon* & *Valentine* 6983; Río Agua Salud, near Frijoles, *Piper* 5844; between Gorgona and Gatún, alt. 10–50 m., *Pittier* 2263; Gatún, *Standley* 27244; *Stevens* 833; *Riley* 108; Fort Sherman, *Standley* 30934; *Stevens* 263; headwaters of the Río Chinilla, above Nuevo Limón, *Maxon* 6898; forests of northerly arm of Quebrada Salamanca as far as falls, alt. 70 m., *Steyermark* & *Allen* 17140. COLÓN: "Aspinwall," *Hayes* 835; around Porto Bello, alt. 5–100 m., *Pittier* 2441; beach between Fató and Playa de Damas, *Pittier* 3933; along Río Fató, alt. 10–100 m., *Pittier* 3909; vicinity of Santa Isabel, *Pittier* 4177; Puerto Obaldía, San Blas coast, alt. 0–50 m., *Pittier* 4380. PANAMÁ: Manzanillo Island, *Hayes* 40, 706; Chararé River, near Chepo, alt. 100–200 m., *Pittier* 4709; vicinity of Arenoso, lower Río Trinidad, alt. 26–50 m., *Seibert* 623. DARIÉN: Boca de Cupe, *Williams* 785; headwaters Río Chico, alt. 150–225 m., *Allen* 4603.

The thin, deeply and inequilaterally cordate leaves more or less pubescent on both sides and densely ciliolate, long, blackening peduncles, and comparatively small, yellowish spikes distinguish this species.

30. *PIPER IMPERIALE* (Miq.) C.DC. in DC. Prodr. 16¹:339. 1869.

Artanthe imperialis Miq. in Seem. Bot. Voy. Herald, 198. 1854.

Piper portobellense C.DC. Smiths. Misc. Coll. 71⁶:6. 1920.

Piper affectans Trel. in Ann. Mo. Bot. Gard. 27:287. 1940.

Piper frijolesanum Trel. var. *grandifolium* Trel. loc. cit. 291. 1940.

Piper gigas Trel. loc. cit. 292. 1940.

A shrub or small tree, commonly 2–5 m. tall; flowering internodes rather elongate and stoutish, commonly somewhat fleshy-warty especially near the nodes,

pubescent or glabrescent; leaves broadly ovate, apex acute or short-acuminate, base somewhat obliquely cordulate with a rather narrow sinus, both sides essentially equal at the petiole or one side a few mm. shorter, up to 29 cm. wide \times 50 cm. long but usually somewhat smaller, pinnately nerved below the upper third or fourth, the nerves 7-8 on each side, the lowermost 3 or 4 approximated near the base, with cross-connecting and anastomosing nervules, submarginally loop-connected, glabrous above, pubescent beneath, at least the nerves puberulent, the midrib beneath with warty excrescences at least near the base, drying firm, brown, opaque; petiole 6-8 or 12 cm. long, puberulent, vaginate-winged nearly to the blade, with warty-excrescences; spikes 8-10 mm. thick \times 30-50 cm. or more long; peduncle 4-6 cm. or more long, sparsely hairy glabrescent; bracts rounded- or triangular-subpeltate, inflexed, yellow-puberulent or glabrate; fruit rather large, obovoid, glabrous, stigmas linear, on a short, stout, deciduous style.

Panama.

CHIRIQUI: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., Woodson, Allen & Seibert 846, 865; Boquete District, Bajo Chorro, alt. 1800 m., Davidson 374. COCLE: vicinity of El Valle, alt. 600-1000 m., Allen 1193. CANAL ZONE: between Frijoles and Monte Lirio, alt. 30 m., Killip 12155; hills north of Frijoles, Standley 27441; Barro Colorado Island, Standley 31273, 41115. COLÓN: forests around Porto Bello, alt. 5-200 m., Maxon 5795. PANAMÁ: Taboga Island, Née 350. DARIÉN: Chepigana Distr., Caña-Cuasi Trail, alt. 600 m., Terry & Terry 1500.

The types of *P. affectans* and *P. frijolesanum* var. *grandifolium* are less warty and the stems are more glabrous than with the other specimens cited, while the young growth of the type of *P. gigas* is somewhat more densely pubescent. The type specimens of both *P. affectans* and *P. gigas* are stated as being trees and with a trunk 30 cm. in diameter. No other differences have been noted in the herbarium specimens, and it is believed that they all represent variations of the same species. So far as discovered, *P. frijolesanum* is a *nomen nudum* as used for var. *grandifolium*.

31. *PIPER TARDENS* Trel. in Ann. Mo. Bot. Gard. 27:298. 1940.

A shrub or small tree, 1-5 m. tall; flowering internodes rather slender and elongated, densely brown-tomentose-pubescent; leaves pentagonally ovate, apex acute, base inequilaterally oblique, rather shallowly and openly cordate, 10-16 cm. wide \times 17-28 cm. long, pinnately nerved from the lower half, the nerves 5-6 on each side, salient beneath, with rather prominent cross-connecting and anastomosing nervules, glabrous above or the midrib sparsely pubescent near the base, hirsute beneath, the nerves densely so, drying coriaceous, opaque; petiole 3-5 cm. long, vaginate-winged to the blade, densely tomentose-pubescent; spikes 5-8 mm. thick \times 25 cm. long; peduncle 2.5-4 cm. long, densely hairy; bracts rounded- or triangular-subpeltate; pedicel brown-villous; fruit globose, stigmas sessile or on a short style (?).

Chiriquí, Panama.

CHIRIQUI: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., Woodson, Allen & Seibert 848; Boquete Distr., Bajo Chorro, alt. 1800 m., Davidson 78, 373.

The densely matted twigs, pentagonally-ovate leaves, glabrous above and hirsute beneath, are characteristic of this species. From the material at hand it has not been possible to determine with certainty regarding the presence of a style. Most of the fruit examined do not exhibit any but in a few there appeared to be a short, thick style. This condition, however, may have resulted from the manner in which the fruit dried and may not represent a true style.

32. *PIPER campanum* Yuncker, sp. nov.

Frutex 2 m. altus, internodiis superis gracilibus elongatis, conferte brunneopubescentibus; foliis lanceolato-ovatis, apice sat attenuatim acuminatis, basi cordato-auriculatis, latere altero 5 mm. breviore, sinu obliquo, a tertio supero deorsum pinnatim venosis, venis utrinque 6-7, utrinque ad venas pubescentibus, glandulosopunctatis; petiolo 2.5-4.5 cm. cum 2-5 mm. longo, conferte brunneo-pubescente, ad laminam vaginato-alato; spicis immaturis, 1 mm. crassis, 5 cm. longis; pedunculo gracili, conferte pubescente.

A shrub, 2 m. tall; upper internodes slender and elongate, densely brown-matted-hairy; leaves lance-ovate, apex somewhat attenuately acuminate, base cordate-auriculate, one side up to 5 mm. shorter at the petiole, the sinus lateral, 11-12 cm. wide \times 26 cm. long, or upper leaves smaller, pinnately nerved below the upper third, the nerves 6-7 on each side, branched upward to some extent, with cross-connecting and anastomosing nervules, the nerves pubescent on both sides or only toward the base on the upper surface, drying rather thin, subtranslucent, glandular-dotted; petiole 2.5-4.5 plus 2-5 mm. long, densely brown-hairy, vaginete-winged to the blade; spikes as yet very young, 1 mm. thick \times 5 cm. long; peduncle slender, 1 cm. long, densely hairy; bracts subpeltate, bristly.

Known only from the type locality.

PANAMÁ: Cerro Campana, vicinity of Campana, alt. 1000 m., April 21, 1941, Allen 2411 (U. S. Nat. Herb., TYPE).

This species resembles *P. tardens* to some extent but differs because of the more acuminate leaf apex, cordate-auriculate base, and more pubescent nerves above.

33. *PIPER CARRILLOANUM* C.DC. in Bull. Soc. Roy. Bot. Belg. 30¹:209. 1891.

Piper vallicolum C.DC. loc. cit. 222. 1891.

Piper paulownifolium C.DC. in Anal. Inst. Fis. Geogr. Costa Rica 9:173. 1898.

Piper tiliaefolium Cham. & Schlechtd. var. *paulownifolium* C.DC. in Candollea 1:154. 1923.

Piper Omega Trel. in Contr. U. S. Nat. Herb. 26:146. 1929.

A shrub, 2-4 m. tall, glabrous except the puberulous nerves on the lower surface; upper internodes moderately slender and elongated; leaves subequilaterally ovate, apex rather long-acuminate, base subtruncate to moderately deeply cordate with open sinus, the blade margin commonly meeting over the petiole, rather small and elongate, 6-8 cm. wide \times 15 cm. long or becoming more rounded and as much as 25 \times 35 cm., pinnately nerved to about the middle, 7-9 nerves on each side, the lowermost 3-5 from near the base, salient beneath, with prominent cross-connecting and anastomosing nervules, very finely nervulose by transmitted light,

drying light green, papery, translucent; petiole slender, 2-5 or even 10 cm. long, vaginulate winged below the middle; spikes about 3 mm. thick \times 15-25 cm. long; peduncle 1-2 cm. long; bracts small, triangular-subpeltate, glabrate; fruit small, obpyramidal-trigonous, gray-papillate, stigmas small, sessile.

Costa Rica and Panama.

CHIRIQUI: Cerro de la Plata, near San Felix, alt. 120-150 m., Pittier 5158; Paso de Quebrada Gata, between Hato Jobo and San Felix, Pittier 5427. CANAL ZONE: hills north of Frijoles, Standley 27612; hills west of the canal, near Gatún, Standley 27226; Mamei Hill, alt. 20-90 m., Pittier 3812; along Caño Quebrado, Pittier 6666; Barro Colorado Island, Miller 2073; Maxon, Harvey & Valentine 6809; Standley 31282, 31293, 40870, 40964; Bailey & Bailey 30; Stevens 645; Pearson Trail, alt. 100 m., Wetmore & Abbe 123; between Gorgona and Gatún, alt. 10-50 m., Pittier 2261. COLÓN: Fató (Nombre de Dios), Pittier 3844. DARIÉN: Boca de Pauarandó, on Sambú River, alt. 20 m., Pittier 5687; Chepigana Distr., Caña-Cuasi Trail, alt. 600 m., Terry & Terry 1475.

This species closely resembles *P. casimirianum* Hemsl. of Nicaragua from which it appears to differ because of the leaf shape and puberulence, as described. It is also quite similar to *P. zacuapanum* of Mexico and may, indeed, be the same. The great variation in the size of the leaves often on the same specimen, leaf shape, puberulent nerves beneath, etc. are distinguishing characteristics.

34. *PIPER PITTIERI* C.DC. in Bull. Soc. Bot. Belg. 29²:69. 1890; 30¹:204. 1891.

A soft shrub, 1 m. or more tall; flowering internodes rather thick and elongated, glabrous, glandular-dotted; leaves broadly ovate, apex abruptly acute or short-acuminate, base truncately shallow-cordate, 14-16 cm. wide \times 15-22 cm. long, pinnately nerved from below the upper third, the nerves about 8 on each side, gradually approximated downward, submarginally loop-connected, with rather prominent cross-connecting-anastomosing nervules, thinly pubescent above, the nerves beneath rather densely villous laterally, ciliate, strongly glandular-dotted on both sides, drying rather thin but firm, translucent; petiole about 6 cm. long, vaginulate-winged to the blade, glabrous, glandular-dotted; spikes 5 mm. thick \times 15 cm. long or in fruit up to 12 mm. thick \times 18 cm. long; peduncle stout, 1.5-2.5 cm. long, puberulent glabrescent, glandular-dotted; bracts triangular-subpeltate, narrowly fringed; fruit angularly oblong, with pointed, substylose apex, stigmas 3.

Costa Rica and adjacent Panama.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, alt. 1800-2100 m., Allen 5012.

The large, somewhat pubescent leaves, rather large spikes, and substylose fruits are distinctive characters of this species.

IV. KEY TO SPECIES PINNATELY NERVED FROM SOMEWHAT BELOW THE MIDDLE TO THE UPPER THIRD OF THE BLADE AND WITH THE LEAVES MOSTLY LESS THAN 20 CM. LONG; IF LONGER, THE BASE IS NOT LOBED.

- a. Leaves scabrous.
- b. Twigs glabrous.
- c. Leaves glabrous on both sides, scabrous beneath, smooth above..... 35. *P. DAVIDANUM*
- cc. Leaves hairy beneath, at least along the nerves.
- d. Leaves mostly 3-4.5 cm. wide, strongly granular-dotted beneath.. 36. *P. MINUTE-SCABIOSUM*

- dd. Leaves 5-6 cm. wide, scarcely granular-dotted beneath..... 52. *P. STORKII*
- bb. Twigs more or less hairy, at least when young.
 - c. Spikes strongly and regularly curved; peduncle longer than the petiole..... 37. *P. ADUNCUM*
 - cc. Spikes not strongly or regularly curved.
 - d. Stem hairs stiff-hispid, comparatively short; leaves harshly scabrous; fruit papillate-puberulent at apex..... 38. *P. HISPIDUM*
 - dd. Stem hairs retrorse; leaves finely scabrous.
 - e. Plant scandent; leaf base obtuse or acutish..... 39. *P. VITABUNDUM*
 - ee. Plant shrubby; leaf base rounded, cordulate..... 78a. *P. WEDELII* var. *RETROHIRSUTUM*
 - ddd. Stem more softly pubescent or villous.
 - e. Hairs on the midrib beneath erect or at least not upcurved-strigose.
 - f. Hairs on midrib beneath mostly up to 1 mm. or more long.
 - g. Leaves mostly 18-20 cm. or more long.
 - h. Leaves 6-8 cm. wide, very slenderly acuminate, base obtuse or cordulate..... 40. *P. PERSUBULATUM*
 - hh. Leaves mostly 10 cm. or more wide, not slenderly acuminate, base rounded-cordate..... 41. *P. PERACUMINATUM*
 - gg. Leaves scarcely up to 15 cm. long.
 - h. Leaves broadly elliptic, less than two times longer than wide..... 73. *P. CATIVALENSE*
 - hh. Leaves 2-3 times longer than wide.
 - i. Leaves rhomboid-elliptic, strongly inequilateral; bracts glabrous..... 42. *P. ERUBESCENTI-SPICUM*
 - ii. Leaves lance-elliptic, elliptic, or elliptic-obovate.
 - j. Petioles scarcely 5 mm. long; stem hairs scarcely 1 mm. long; blades slightly scabrous..... 72. *P. PSEUDO-GARAGARANUM*
 - jj. Petioles up to 2 cm. long downward.
 - k. Blades mostly 5-8 cm. wide, scarcely scabrous above..... 43. *P. CULEBRANUM*
 - kk. Blades 3-4.5 cm. wide, harshly scabrous above..... 44. *P. VIRIDICAULE*
 - ff. Hairs on midrib mostly scarcely 0.5 mm. long, dense.
 - g. Leaves less than 5 cm. wide; veins above impressed in age..... 45. *P. PERVELUTINUM*
 - gg. Leaves 6-8 cm. wide; veins not impressed..... 46. *P. VARIITRICHUM*
 - ee. Hairs on the midrib beneath strongly upcurved and appressed or strigose.
 - f. Leaves less than 4 cm. wide..... 47. *P. CHANGUINOLANUM*
 - ff. Leaves mostly wider.
 - g. Blades moderately to densely hairy on the upper surface.
 - h. Peduncle scarcely 5 mm. long; blades villous above and harshly scabrous; bracts of young spikes not conspicuously bristly..... 48. *P. VILLARAMULUM*
 - hh. Peduncle 5-10 mm. or more long; blades crisp-hirtellous or subhispid above, slightly scabrous; young spikes very short, conspicuously bristly from erect marginal hairs.
 - i. Leaves mostly narrowed downward, usually only the longer side rounded at the base..... 49. *P. TABOGANUM*
 - ii. Leaves rounded-cordulate on both sides..... 50. *P. PSEUDO-CATIVALENSE*
 - gg. Blades sparsely hairy or glabrous, hairy mostly only along the nerves above.
 - h. Young spikes not conspicuously bristly because of the erect bract hairs.
 - i. Bracts prominently densely yellow-fringed..... 70. *P. LEPTOCLADUM*
 - ii. Bracts very narrowly and sparsely fringed.
 - j. Nerves beneath spreading-hirsute..... 51. *P. LUCIGAUDENS*
 - jj. Nerves beneath obscurely strigose..... 52. *P. STORKII*
 - iii. Bracts glabrous, with a dorsal callus..... 78. *P. WEDELII*
 - hh. Young spikes about 1 cm. long, conspicuously bristly because of erect bract hairs..... 49. *P. TABOGANUM*

aa. Leaves not noticeably scabrous.

b. Spikes short, scarcely exceeding 2 cm. in length.

c. Stems and leaves glabrous.

d. Spikes less than 1 cm. long; bracts glabrous..... 53. *P. WAGNERI*

dd. Spikes about 2-3 cm. long; bracts densely ciliate..... 54. *P. DUNLAPI*

cc. Stems and/or leaves hairy.

d. Stems glabrous or sparsely pubescent; nerves beneath appressed-puberulent..... 55. *P. PALMASANUM*

dd. Stems rather densely hairy, at least when young..... 16. *P. COLON-INSULAE*

bb. Spikes longer, mostly 3-5 cm. or more long (or unknown).

c. Stems and leaves essentially glabrous (nerves hirtellous or puberulous in *P. carilloanum* and *P. aequale* var. *laurifolium*).

d. Peduncle 4-7 cm. long..... 56. *P. REPTABUNDUM*

dd. Peduncle scarcely 2 cm. long at most.

e. Leaves ovate.

f. Base mostly acute at the petiole; petiole 1-2.5 cm. long..... 57. *P. CHIRIQUINUM*

ff. Base obtuse to cordate.

g. Leaves 10-14 cm. long; petiole 5 mm. long..... 65. *P. TECUMENSE*

gg. Leaves 15 cm. or more long; petiole 1-2 cm. or more long.

h. Nerves beneath puberulous; peduncle 1-2 cm. long..... 33. *P. CARRILLOANUM*

hh. Nerves beneath glabrous; peduncle 0.5-1 cm. long..... 93. *P. GRANDE*

ee. Leaves elliptic, lance-elliptic, subobovate or obovate.

f. Leaves mostly 2.5-4.5 cm. wide (rarely wider); apex sharply to strongly mucronate-acuminate.

g. Leaves scarcely more than 2-2½ times longer than wide.

h. Base acutely decurrent, apex strongly mucronate..... 58. *P. TENUIMUCRONATUM*

hh. Base rounded, obtuse..... 59. *P. SEPTULINERVUM*

gg. Leaves mostly 3-4 times longer than wide, or base not decurrent.

h. Bracts smooth; leaves not glandular.

i. Leaf base rounded, obtuse; nerves 4-5 on each side.... 59. *P. SEPTULINERVUM*

ii. Leaf base narrowed, acute to cuneate; nerves 3-4 on each side..... 60. *P. SUBQUINQUENERVE*

hh. Bracts conspicuously yellow-fringed; leaves more or less glandular-dotted.

i. Leaves drying dull, yellow..... 61. *P. INFRALUTEUM*

ii. Leaves drying glossy, green..... 80b. *P. HIRTELLIPETIOLUM*
var. *HARVEYANUM*

ff. Leaves larger, mostly 5 cm. or more wide.

g. Leaves nerved from about the lower third, sharply abruptly acuminate..... 62. *P. CRICAMOLENSE*

gg. Leaves nerved to about or above the middle.

h. Leaves mostly 4- to 5-nerved on each side of the midrib (or sometimes 6 in *P. aequale*).

i. Leaves obovate, revolute, apex mostly obtuse..... 10. *P. MACROPUNCTATUM*

ii. Leaves oblong-elliptic-subobovate, apex abruptly blunt-acuminate..... 63. *P. AEQUALE*

iii. Leaves elliptic, apex gradually acuminate.

j. Leaves, petioles, etc. strongly glandular-dotted..... 64. *P. SAMBUANUM*

jj. Leaves, etc. not glandular-dotted..... 65. *P. TECUMENSE*

hh. Leaves 7-nerved on each side of the midrib, oblong-ovate, 10-13 cm. wide..... 66. *P. CRASSISPICATUM*

cc. Stems and/or leaves more or less hairy (minutely and obscurely so in *P. calliobracteum*).

d. Leaves nerved from the lowermost $\frac{1}{4}$ or $\frac{1}{2}$ 67. *P. BOGOTENSE*

dd. Leaves nerved mostly to about the middle or above.

e. Leaf base with one side strongly auriculate and covering the petiole (auricle about 1 cm. or more long).

f. Pubescence strongly dimorphic; leaves 6 cm. or more wide.... 68. *P. SPERDINUM*

ff. Pubescence not dimorphic; leaves less than 5 cm. wide..... 69. *P. PERBREVICAULE*

ee. Leaf base may be cordulate but scarcely auriculate.

f. Leaves hairy on the upper surface, at least along the midrib above the very base.

g. Leaves 10×25 cm. or more..... 85. *P. COLONENSE*
 gg. Leaves mostly smaller.
 h. Pubescence on the upper leaf surface restricted to the nerves.
 i. Nerves beneath glabrous; spike 2-3 cm. long..... 59a. *P. SEPTUPLINERVUM*
 var. *SUBPUBINERVUM*
 ii. Nerves beneath obviously hairy..... 70. *P. LEPTOCLADUM*
 hh. Pubescence not so restricted.
 i. Leaves 6-7 cm. wide, scarcely 3 times longer than wide; spikes straight.
 j. Crisp-hirtellous or subhispid above; young spikes short, bristly..... 49. *P. TABOGANUM*
 jj. Sparsely long-villous above, glabrescent; young spikes not noticeably bristly.
 k. Peduncle up to 6 cm. long; stem and leaf hairs strongly dimorphic..... 71. *P. DIMORPHOTRICHUM*
 kk. Peduncle much shorter; hairs not obviously dimorphic.
 l. Apex gradually acuminate, blades 15-20 cm. long..... 72. *P. PSEUDO-GARAGARANUM*
 ll. Apex abruptly acuminate, blades 12-14 cm. long..... 73. *P. CATIVALENSE*
 ii. Leaves mostly narrower, 3-4 times or more longer than wide, rugescent, appressed-pubescent above; spikes commonly curved.
 j. Nerves mostly 7-8 on each side; leaves mostly 3-5 cm. or more wide..... 74. *P. PSEUDO-LANCEAEFOLIUM*
 jj. Nerves mostly 4-5 on each side; leaves mostly 2-3.5 cm. wide..... 75. *P. LINEARIFOLIUM*
 ff. Leaves glabrous above.
 g. Fruit and ovary papillate-pubescent.
 h. Petioles scarcely 10 mm. long.
 i. Spikes 2-3 mm. \times 7-8 cm.; plant vine-like..... 39. *P. VITABUNDUM*
 ii. Spikes 3-5 mm. \times 4-5 cm.; plant shrubby..... 76. *P. PANAMENSE*
 hh. Petioles up to 3 cm. long; spikes 8-10 cm. long..... 77. *P. CALLIBRACTEUM*
 gg. Fruit glabrous, or unknown.
 h. Stems glabrous or essentially so.
 i. Leaf nerves beneath thinly strigose; bracts glabrous.... 78. *P. WEDELII*
 ii. Leaf nerves beneath obscurely puberulent; bracts fringed.
 j. Leaves 7-10 cm. wide..... 79. *P. VERRUCULAE-PETIOLUM*
 jj. Leaves less than 6 cm. wide..... 65. *P. TECUMENSE*
 hh. Stems obviously pubescent, at least when young.
 i. Leaf base narrowed, acute or obtusish, the sides nearly equal.
 j. Nerves beneath glabrous; spikes about 4-5 cm. long..... 80. *P. HIRTELLIPETIOLUM*
 jj. Nerves beneath pubescent; spikes 5-6 cm. long.... 80a. *P. HIRTELLIPETIOLUM*
 var. *TAPIANUM*
 ii. Leaf base with one or both sides rounded-obtuse, or the longer side mostly cordulate.
 j. Bracts conspicuously fringed; spikes 3-4 mm. thick.
 k. Lateral nerves loop-connected upward, not continuing toward the apex..... 81. *P. SUBCAUDATUM*
 kk. Lateral nerves not strongly loop-connected upward, continuing unbroken toward the apex.... 43. *P. CULEBRANUM*
 jj. Bracts essentially glabrous; spikes 7-8 mm. thick.... 82. *P. GONOCARPUM*

35. *PIPER DAVIDANUM* C.DC. in Smiths. Misc. Coll. 71⁶:9. 1920.

A shrub, 2 m. tall, nodose; flowering internodes moderately slender, glabrous, granular, with subnodal lenticels; leaves elliptic, apex rather short-acuminate, base inequilateral, one side 4-5 mm. shorter and acute, the longer side rounded, 6-9 cm. wide \times 16-19 cm. long, glabrous on both sides, finely scabrous and glandular-dotted beneath, smooth above, pinnately nerved below the upper third, the nerves rather prominent beneath, 5-6 on each side, with slender cross-connecting and anastomosing nervules, drying pale green, membranous, translucent; petiole 6 plus 4-5 mm. long, vaginate at the base, glabrous; spikes 3 mm. thick \times 8-10 cm. long; peduncle 5-7 mm. long, glabrous; bracts triangular-lunate-subpeltate, sparsely papillate-fringed; fruit oblong-tetragonal, granulate-papillate at the top, stigmas sessile.

Known only from the following locality.

CHIRIQUI: vicinity of David, along streamlet, alt. 30-80 m., Pittier 2837.

The glabrous stems and leaves, and scabrous lower leaf surface characterize this species.

36. *PIPER MINUTE-SCABIOSUM* Trel. in Ann. Mo. Bot. Gard. 27:294. 1940.

Piper minute-scabiosum var. *arborescens* Trel. loc. cit. 1940.

A shrub or small tree, up to 3 m. tall, somewhat twig., nodose; flowering internodes slender, lepidote-granular, glabrous; leaves narrowly elliptic or lance-elliptic, apex caudately acuminate, base inequilateral, acute or obtuse, one side 1-3 mm. shorter, 2.5-4 cm. wide \times 9-15 cm. long, pinnately nerved from the lower half, the nerves 4 or 5 on each side, with inconspicuous cross-connecting nervules, glabrous and smooth above, scabrous and the nerves strigose-hairy beneath, glandular-dotted on both sides, drying rather firm, translucent; petiole 5-8 plus 1-3 mm. long, granular, vaginate at the base; spikes 2-3 mm. thick \times 8 cm. long, cuspidate; peduncle 1-1.5 cm. long, glabrous; bracts triangular-lunate-subpeltate, rather sparsely short-fringed; ovary compressed-ovoid, papillate about the apex; stigmas sessile.

Known only from the following locality.

COCLÉ: north rim of El Valle de Antón, alt. 600-1000 m., Allen 1639; vicinity of El Valle, alt. 600-1000 m., Allen 1185; along Rio Indio Trail, alt. 500-700 m., Hunter & Allen 333.

The only difference which can be noted between the type of the variety and that of the species is the collectors' notations of the habit of growth. Because of the great variation in this character it is not believed to be valid in this case. The species was described as a shrub 3 m. tall, and the variety as a small tree 2.5 m. tall.

37. *PIPER ADUNCUM* L. Sp. Pl. 1:29. 1753.

Piper elongatum Vahl, Enum. Pl. 1:312. 1805, sensu Trelease in Contr. U. S. Nat. Herb. 26:36. 1927.

Piper celtidifolium H.B.K. Nov. Gen. & Sp. 1:50. 1815.

Artanthe adunca Miq. Comm. Phyt. 49. 1838.
Steffensia adunca Kunth, in Linnaea 13:633. 1939.
Artanthe celtidifolia Miq. Syst. Pip. 452. 1848.
Piper fatoanum C.DC. in Smiths. Misc. Coll. 71⁶:7. 1920.
Piper aduncum var. *laevifolium* C.DC. loc. cit. 8. 1920.
Piper elongatum var. *laevifolium* (C.DC.) Trel. in Contr. U. S. Nat. Herb. 26:37. 1927.
Piper intersitum Trel. in H. Daniel, Una Ascension Al Cerro de "La Vieja," Medellín, Colombia, 12. 1940, in part.
Piper intersitum var. *porcicitense* Trel. loc. cit. 13. 1940.

Shrub or small tree, mostly 3–9 m. tall, nodose; flowering internodes rather slender, short, rather sparsely pubescent glabrescent; leaves lanceolate to subelliptic, 4–8 or scarcely 10 cm. wide \times 12–24 cm. long, apex sharp-acuminate, base inequilaterally rounded or cordulate, one side mostly 3–4 mm. shorter, pinnately nerved to the middle or upper third, the nerves 6–8 on each side, sharply ascending, the innermost meeting at the apex, gradually approximated downward with usually 2 or 3 on each side very near the base, scabrous and more or less pubescent above, at least along the nerves, commonly tardily somewhat rugulose, pubescent or glabrescent between the nerves and somewhat glandular-dotted beneath, the nerves commonly subappressed-hairy, drying firm, translucent, pellucid-dotted; petiole 3–8 plus 3–4 mm. long, pubescent, vaginate at the base; spikes 3–4 mm. thick \times 8–15 cm. long, short-cuspidate, gradually curved or hooked; peduncle slender, 8–20 mm. long, mostly about 10–12 mm., puberulent; bracts triangular- or rounded-subpeltate, marginally fringed; fruit small, obovoid, more or less tri- or tetragonal, glabrous, stigmas sessile.

West Indies and on the mainland through Central America and northern South America.

BOCAS DEL TORO: Cricamola Valley, vicinity of Almirante, *Cooper* 531; Isla Colón, alt. 0–120 m., *von Wedel* 515. CANAL ZONE: vicinity of Fort Sherman, *Standley* 30941; near Río Medio, Battery 46 Hill, *Miller* 1770; near old Fort Lorenzo, mouth of Río Chagres, *Piper* 5985; between Chagres Batteries and Fort San Lorenzo, Fort Sherman Military Reservation, *Maxon* & *Valentine* 6992; hills west of the canal, near Gatún, *Standley* 27256; alluvial bottom near Bohio, alt. 10–20 m., *Maxon* 4766; Madden Dam Road, *Miller* 1803. COLÓN: along the beach between Fató and Playa de Damas, *Pittier* 3935, 3930; forests around Porto Bello, alt. 5–100 m., *Pittier* 2438. PANAMÁ: near Tapia River, Juan Diaz region, *Maxon* & *Harvey* 6671; Tumba Muerto Road, near Panamá, *Standley* 29803; forests, on dry limestone, around Alhajuela, Chagres Valley, alt. 30–100 m., *Pittier* 3510.

37a. *PIPER ADUNCUM* var. *brachyarthrum* (Trel.) Yuncker, comb. nov.

Piper elongatum var. *brachyarthrum* Trel. in Contr. U. S. Nat. Herb. 26:37. 1927.
Piper Cuatrecasasii Trel. in Trab. Mus. Nac. Hist. & Jard. Bot. Madrid, Ser. Bot. 33:48.
 1936.
Piper cumbricola Trel. loc. cit. 1936.
Piper cumbricola var. *montevagum* Trel. loc. cit. 1936.
Piper illudens Trel. loc. cit. 50. 1936.

Stems densely hirsute-villous; leaves moderately to densely soft-villous beneath.
 Occurs with the species.

PANAMÁ: without locality, *Seemann* 117. CHIRIQUÍ: vicinity of El Boquete, alt. 1000-1300 m., March 2-8, 1911, *Maxon* 5139 (U. S. Nat. Herb., TYPE). VERAGUAS: vicinity of Santiago, alt. 50 m., *Allen* 1016. COCLÉ: El Valle, *Miller* 1815, 816. CANAL ZONE: Chiva-Chiva Trail, Red Tank to Pueblo Nuevo, *Piper* 5749.

This is a widespread species which exhibits considerable variation in the size of the leaves and character and amount of pubescence. The rather slender, regularly curved spikes, short petioles, and somewhat longer peduncles are characteristic features. Variety *laevifolium* has slightly less scabrous leaves but otherwise agrees in all respects.

38. *PIPER HISPIDUM* Sw. Prodr. Veg. Ind. Occ. 15. 1788.

Piper scabrum Sw. Fl. Ind. Occ. 1:59. 1797.
Piper birsutum Sw. loc. cit. 60. 1797.
Steffensia birsuta Kunth, in Linnaea 13:640. 1839.
Steffensia scabra Kunth, loc. cit. 1839.
Artanthe birsuta Miq. Syst. Pip. 446. 1844.
Artanthe scabra Miq. loc. cit. 447. 1844.
Piper erectamentum C.DC. in Smiths. Misc. Coll. 71⁶:14. 1920.
Piper scabrilimbum C.DC. in Candollea 1:121, 276. 1923.
Piper Williamsii Trel. in Contr. U. S. Nat. Herb. 26:32. 1927.
Piper Killipii Trel. loc. cit. 33. 1927.
Piper Killipii var. *calderanum* Trel. loc. cit. 1927.
Piper sancti-felicis Trel. loc. cit. 35. 1927.
Piper rivi-vetusti Trel. in Ann. Mo. Bot. Gard. 24:186. 1937.
Piper barbirostre Trel. loc. cit. 27:288. 1940.
Piper casitense Trel. loc. cit. 289. 1940.
Piper cerro-pantoense Trel. loc. cit. 1940.
Piper konkintoense Trel. loc. cit. 293. 1940.
Piper Margaretae Trel. loc. cit. 1940.
Piper pervicax Trel. loc. cit. 296. 1940.
Piper pseudo-viridicaule Trel. var. *nievecitanum* Trel. loc. cit. 1940.

A shrub, up to 5-8 m. or more tall, rather nodose; flowering internodes moderately slender and rather short, hispid, sometimes glabrescent downward, hairs rigid, commonly more dense about the nodes, erect to reflexed, often of varying lengths; leaves elliptic or elliptic-ovate, 4-11 cm. wide \times 11-20 or 25 cm. long, mostly 6-8 \times 11-15 cm., apex acuminate, base obliquely inequilateral, one side 2-5 mm. shorter, mostly acute, the longer side usually rounded and obtuse, or in large leaves sometimes cordulate, pinnately nerved from the

lower half, the nerves 5–6 on each side or 7 in some large leaves, with cross-connecting nervules, sometimes rugescent in age, lepidote-scabrous, more or less hirtellous or hispid along the nerves above, the nerves beneath hispid-hirsute, commonly glandular-dotted, drying papery, translucent; petiole 5–10 plus 2–5 mm. long, hirtellous or hispid, vaginate at the base; spikes 3 mm. thick \times 8–14 cm. long, mucronate; peduncle rather thick, scarcely 1 cm. long, hirtellous or hispid; bracts triangular-subpeltate, marginally fringed; fruit rather small, oblong-subpyramidal-trigonous, laterally compressed, papillate-puberulent at the truncate or depressed apex; stigmas small, sessile.

In a number of scarcely distinguishable forms throughout the West Indies, Central America, and much of South America.

BOCAS DEL TORO: Río Cricamola, between Finca St. Louis and Kontintoë, alt. 10–50 m., *Woodson, Allen & Seibert 1894*; vicinity of Nievecita, alt. 0–50 m., *Woodson, Allen & Seibert 1894*; Daytona Farm, region of Almirante, *Cooper 165*. **CHIRIQUÍ:** vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, alt. 1800–2000 m., *Allen 1365*; valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m., *Seibert 192*; on trail to Cerro Punta, *White 52, 158*; Bajo Chorro, Boquete Distr., alt. 1800 m., *Davidson 58, 342*; El Boquete, alt. 1400–1650 m., *Killip 3549*; around Las Siguas Camp, southern slope of Cerro de la Horqueta, alt. 1700 m., *Pittier 3191*; Río Caldera, above El Boquete, alt. 1600 m., *Killip 3544*; vicinity of San Felix, alt. 0–120 m., *Pittier 5124*; vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m., *Woodson, Allen & Seibert 843, 902, 978*. **CANAL ZONE:** Empire, *Miller 1868*; Barro Colorado Island, Gatún Lake, *Standley 31387*. **PANAMÁ:** Marraganti and vicinity, alt. 3–60 m., *Williams 986*; Indio, Madden Lake, *Miller 2064*. **DARIÉN:** Boca de Pauarandó, on Sambú River, alt. 20 m., *Pittier 5584*—some of the leaves on this specimen are up to 10–11 \times 22–24 cm.

38a. *PIPER HISPIDUM* var. *trachydermum* (Trel.) Yuncker, comb. nov.

Piper trachydermum Trel. in Contr. U. S. Nat. Herb. 26:33. 1927.
Piper non-retrosum Trel. loc. cit. 36. 1927.

Differs from the species in having the short, stout hairs on the upper internodes upwardly curved and more or less appressed.

Occurs with the species.

PANAMA: without location, 1859–60, *Hayes 791* (Herb. New York Bot. Gard., TYPE of *P. trachydermum*). **COCLÉ:** El Valle, valley floor and lower slopes, along highway, *Miller 1817*—leaves on this specimen are larger than usual. **CANAL ZONE:** Barro Colorado Island, Gatún Lake, alt. 120 m., *Standley 40872*; vicinity of Fort Sherman, *Standley 30121*. **COLÓN:** around Porto Bello, alt. 5–100 m., *Pittier 2429*. **PANAMÁ:** Río Tapia, *Standley 28208*.



Fig. 7. *Piper hispidum*

38b. *PIPER HISPIDUM* var. *ellipticifolium* Yuncker, var. nov.

Caule hispido (pilis rigidis seorsum recurvantibus); foliis ellipticis, deorsum ad basem sensim angustatis, basi utrinque peracutis.

Stem hispid, the hairs rigid, upcurved; leaves elliptic, gradually narrowed to the base which is scarcely rounded and strongly acute on both sides, 7-8 cm. wide \times 13-16 cm. long.

Known only from the type locality.

COCLÉ: Bismarck, above Penonomé, alt. 600-900 m., March 5-19, 1908, *Williams* 343 (Herb. New York Bot. Gard., TYPE).

There is a great amount of variation in the size and to a lesser degree also the shape of the leaves on the specimen included here. All agree in having harshly scabrid leaves, hispid stems, and papillate-puberulent fruit. A study of the type specimens of the numerous species proposed by DeCandoile and by Trelease has failed to show any consistent characters upon which it is believed specific distinctions can be justified.

39. *PIPER VITABUNDUM* Trel. in Contr. U. S. Nat. Herb. 26:38. 1927.

Piper conscendens Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:338. 1937.

Climbing; flowering internodes rather slender and long, moderately retrorse-strigose; leaves elliptic, apex acuminate, base inequilateral, one side 1-3 mm. shorter and acutish, the longer side acutish or obtuse, 3-4 cm. wide \times 10-12 cm. long, pinnately nerved from the lower half, the nerves 4-5 on each side, lepidote, finely scabrous, and glabrous above, the nerves beneath appressed-pubescent, drying dark, subopaque; petiole about 5 plus 1-3 mm. long, pubescent, vaginate at the base; spikes 2-3 mm. thick \times 7-8 cm. long; peduncle scarcely 1 cm. long, sparsely crisp-pubescent; bracts triangular-subpeltate, narrowly fringed; fruit oblong-subtetragonal, laterally compressed, papillate-puberulent at the top, stigmas sessile.

Known only from Changuinola Valley, Bocas del Toro.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 338.

The vine-like habit of this species is distinctive. *P. conscendens* was based on the same collection as *P. vitabundum*.

40. *PIPER PERSUBLATUM* C.DC. in Smiths. Misc. Coll. 71⁶:4. 1920.

Shrub (?); flowering internodes rather slender and short, densely brown-villous, the hairs up to 1 mm. or more long; leaves lance-elliptic-oblong, with the midrib nearer one side, apex very narrowly long-acuminate, base subequally rounded, 5.5-8 cm. wide \times 19-24 cm. long, pinnately nerved from the lower half, the nerves 6-7 on each side, with prominent cross-connecting nervules, the upper surface somewhat scabrous, loosely villous, the nerves rather densely so, marginally strongly long-ciliate, more densely dingy-hairy beneath, drying papery, subopaque; petiole scarcely 5 mm. long, densely villous, vaginate at the base; spikes 2 mm. thick \times 10 cm. long; peduncle scarcely 5 mm. long, villous; bracts subpeltate, densely dingy-hairy; ovary elongated with the rachis, glabrous, stigmas sessile.

Known only from the following locality.

COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), Pittier 4240.

The densely villous stems and leaves, long, slenderly acuminate leaves, and densely hairy bracts distinguish this species.

41. *PIPER PERACUMINATUM* C.D.C. in Smiths. Misc. Coll. 71⁶:9. 1920.

A shrub or small tree, 2-3 m. tall; flowering internodes moderately short and stout, hirsute, the hairs of various lengths; leaves elliptic-ovate, apex narrowly sharp-acuminate, base inequilateral, cordulate, the longer side 2-4 mm. longer at the petiole and covering the petiole, 8-13 cm. wide \times 16-27 cm. long, scabrous above and loosely villous or at least pubescent along the nerves, thinly long-hairy beneath, ciliate, somewhat rugescent or nearly smooth, pinnately nerved from the lower half, the nerves 6 or 7 on each side, drying rather thin, subtranslucent; petiole 5-10 plus 2-4 mm. long, densely hirsute, vaginate-winged to the blade; spikes 5 mm. thick \times 10-13 cm. long; peduncle rather stout, 2 cm. long, with intermixture of short, stiff, and long, crisp hairs; bracts rounded- or triangular-subpeltate, fringed, pedicel villous; fruit oblong, compressed, rusty-hirtellous, stigmas sessile.

Panama.

CANAL ZONE: Chagres, Fendler 269. COLÓN: around Dos Bocas, Río Fató valley, alt. 40-80 m., Pittier 4210; Río Indio de Fató, Pittier 4254.

The rather large, scabrid, cordulate-based leaves, mixture of long and short stiff hairs, and hairy fruits distinguish this species.

42. *PIPER ERUBESCENTISPICUM* Trel. in Ann. Mo. Bot. Gard. 27:291. 1940, as *erubescenspica*.

A shrub, 2 m. tall, nodose; flowering internodes rather short and slender, evanescently villous; leaves rhombic-elliptic, apex sharp-acuminate, base inequilateral, cordulate, one side 2-4 mm. shorter, 4-6.5 cm. wide \times 10-14 cm. long, pinnately nerved from the lower half, the nerves 4-5 on each side, with rather prominent cross-connecting nervules, harshly scabrous, sparsely villous above, the hair bases enlarged, whitish, loosely villous beneath, at least along the nerves, the hairs more or less erect, up to 1 mm. or more long, marginally ciliate, young leaves woolly-villous when unfolding, drying papery, translucent; petiole scarcely 5 plus 2-4 mm. long, at first villous, vaginate at the base; spikes red, as reported, 2 mm. thick \times 6 cm. long; peduncle about 5 mm. long, glabrescent; bracts glabrous, triangular-subpeltate, dorsally somewhat projected and callose, slightly ciliate beneath; fruit not developed, stigmas sessile.

Bocas del Toro.

BOCAS DEL TORO: vicinity of Nievecita, alt. 0-50 m., Woodson, Allen & Seibert 1817; Sansan Swamp, region of Almirante, Cooper 190.

The villous, more or less rhombic-elliptic, scabrous leaves, red spikes, and irregularly shaped bracts distinguish this species.

43. *PIPER CULEBRANUM* C.DC. in *Candollea* 1:121, 243. 1923.

A shrub or small tree, 2 m. tall; upper internodes comparatively short and slender, loosely to moderately crisp-villous; leaves elliptic, elliptic-ob lanceolate or elliptic-subobovate, apex acutely long-acuminate, base 3-5 mm. shorter on one side, obtuse, or longer side cordulate, 5-7 or sometimes 9 cm. wide \times 15-20 cm. long, pinnately nerved from the lower half, the nerves 4-5 on each side, with cross-connecting and anastomosing nervules, sparsely white-villous glabrescent above, mostly crisp-villous and slightly scabrous beneath, the nerves more densely so, drying rather thin, green, somewhat glossy, translucent; petiole mostly about 5 plus 3-5 mm. long, crisp-villous, vaginate at the base; spikes 4 mm. thick \times 7-9 cm. long; peduncle 1 cm. long, crisp-villous; bracts round-triangular-subpeltate, with a wide, dense yellow fringe; fruit subcylindrical, truncate; stigmas sessile.

Central Panama.

CANAL ZONE: Empire, Miller 1866; near Fort Randolph, Standley 28622, 28667. COLÓN: along the Rio Culebra, above Santa Isabel, near sea-level, Pittier 4154; between France Field, Canal Zone and Catival, Standley 30375. PANAMÁ: Juan Diaz, Standley 30611; along Rio Juan Diaz above Juan Diaz, alt. 30 m., Allen 934.

There is considerable variation in the size of the leaves on the specimens included here, especially Miller's No. 1866, but they agree very well otherwise, and it is believed they all represent the same species.

44. *PIPER VIRIDICAULE* Trel. in *Contr. U. S. Nat. Herb.* 26:32. 1927.

A shrub, 2 m. tall, branches subdichotomously forked; flowering internodes slender, elongating downward, villous, the hairs up to 1 mm. or more long; leaves lance-elliptic, apex sharp-acuminate, base inequilateral, cordulate, one side 2-4 mm. longer and covering the petiole, 3-4.5 cm. wide \times 9-12 cm. long, pinnately nerved from the lower half, the nerves 4 or occasionally 5 on each side, with slender cross-connecting nervules, sparsely villous and harshly scabrous above, paler beneath and appressed-villous, especially along the nerves, marginally long-ciliate, pale-glandular-dotted beneath, drying thin, translucent; petiole 5-20 plus 2-4 mm. long, villous, vaginate at the base; spikes unknown.

Known only from Barro Colorado Island.

CANAL ZONE: Barro Colorado Island, Gatún Lake, Standley 31402.

The absence of inflorescence on the only specimen known of this species makes its position questionable. The vegetative characters, especially the villous twigs and leaves, distinguish it from any other known species.

45. *PIPER PERVELUTINUM* Trel. in *Contr. U. S. Nat. Herb.* 26:39. 1927.

Shrub (?), nodose; flowering internodes short, rather stout, densely subvillous; leaves lance-oblanceolate, apex subacute, base inequilateral, rounded, obtuse, one side 2-5 mm. shorter, the upper surface rugose, scabrous, hirsute, especially along the nerves, dull, densely dingy-villous and slightly scabrous beneath, not ciliate, pinnately nerved from the lower half, the nerves 6-7 on each side, impressed above,

gradually approximated downward, drying rather thick, opaque; petiole 8–10 plus 2–5 mm. long, densely dingy-villous, clasping and vaginate at the base; spikes as yet immature, 2 mm. thick \times 1.5 cm. long; peduncle short, densely hairy; bracts round-subpeltate, fringed, the dorsal hairs much longer; ovary not formed.

Known only from the one specimen.

PANAMA: without locality, Hayes 796.

46. *Piper variitrichum* Yuncker, sp. nov.

Frutex 1–2 m. altus, caulis nodosis; internodiis floriferis gracilibus conferte atro-pubescentibus; foliis ovato-ellipticis, apice acute acuminatis, basi inaequilateraliter obliquis, latere angusto obtuso vel acuto, latere lato rotundato cordulato, supra conferte scabridis, a tertio supero deorsum pinnatim venosis, venis utrinque 5–6, supra hispidis subitus pubescentibus, ad venas sat conferte hirsutis, pilis erectis brevioribus longioribusque intermixtis; petiolo 1–1.5 cm. longo, conferte hirsuto, deorsum vaginato; spicis immaturis 2 mm. crassis, 4 cm. longis apiculatis; pedunculo 5 mm. longo conferte pubescente; bracteis rotundato-subpeltatis fimbriatis.

Shrub, 1–2 m. tall, nodose; flowering internodes slender, lengthening downward, densely dingy-pubescent; leaves ovate-elliptic, apex narrowly attenuately acuminate, base inequilaterally oblique, essentially equal length at the petiole, the narrower side narrowing downward, obtuse or acutish, the broader side rounded, cordulate, 6–8 cm. wide \times 15–23 cm. long, harshly scabrous above, less so beneath, pinnately nerved below the upper third, the nerves 5–6 on each side, with slender, cross-connecting nervules, glandular-dotted and hispid above, pubescent beneath with the nerves rather densely staring-hairy with a mixture of various length hairs, scarcely ciliate, drying rather thin, translucent; petiole 1–1.5 cm. long, densely hairy, vaginate toward the base; spikes as yet young, 2 mm. thick \times 4 cm. long, apiculate; peduncle 5 mm. long, densely pubescent; bracts round-subpeltate, fringed, with a few dorsal hairs longer; ovary and fruit not developed.

Known only from the type locality.



Fig. 8. *Piper variitrichum*

DARIÉN: Chepigana Distr., Caña-Cuasi Trail (Camp 2), alt. 600 m., March 9, 1940, *Terry & Terry 1428* (Herb. Missouri Bot. Gard., TYPE).

The comparatively large leaves, narrowly acuminate apex, the margins essentially equal at the petiole, and various length hairs on the nerves beneath distinguish this species.

47. *PIPER CHANGUINOLANUM* Trel. in Contr. U. S. Nat. Herb. 26:37. 1927.

A nodose shrub with scabrous twigs and leaves; flowering internodes short and comparatively slender, finely hispid and granular; leaves inequilateral, narrowly elliptic-oblong, apex acuminate, base 2-4 mm. shorter on one side and acute, the longer side rounded, cordulate, 3-4 cm. wide \times 12-15 cm. long, pinnately nerved from below the middle, the nerves 5-6 on each side, rather slender but conspicuous beneath, with slender cross-connecting nervules, slightly rugose in age, the nerves above hispidulous, paler and granular-dotted beneath and appressed-pubescent on the nerves, appressed-hispidulous ciliate, drying papery, translucent; petiole scarcely 5 plus 2-4 mm. long, hispid, vaginate at the base; spikes 3 mm. thick \times 8-10 cm. long; peduncle scarcely 1 cm. long, subappressed-hispid; bracts rounded-triangular-subpeltate, thinly stiff-ciliate, the anterior setae longer; fruit oblong, laterally-compressed, apex depressed-truncate, granulate or essentially glabrous, stigmas sessile.

Known only from Changuinola Valley, Bocas del Toro.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 233.

48. *PIPER VILLIRAMULUM* C.D.C. in Smiths. Misc. Coll. 71⁶:11. 1920.

Piper bocasense Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:333. 1937.

Piper yapeanum Trel. in Ann. Mo. Bot. Gard. 25:827. 1938.

A shrub or small tree, commonly 2-3 m. tall; flowering internodes moderately slender, moderately to rather densely villous; leaves ovate or elliptic-ovate, apex acuminate, base inequilaterally oblique, one side 3-5 mm. shorter and obtuse, the longer side rounded, cordulate, mostly 5-8 cm. wide \times 13-18 cm. long, occasional leaves somewhat larger, scabrous on both sides but more harshly so above, moderately appressed-hairy on both sides, becoming somewhat bullulate, pinnately nerved from the lower half, the nerves 6 or 7 on each side, drying rather thin, translucent; petiole 5-10 plus 3-5 mm. long, vaginate at the base, moderately to densely villous; spikes 3 mm. thick \times 7-9 cm. long; peduncle rather stout, scarcely 5 mm. long, hairy; bracts rounded-triangular-subpeltate, fringed, the hairs comparatively short, coarse and somewhat rigid; fruit tetragonal, laterally compressed, glabrous or obscurely papillate at the apex, stigmas sessile.

Panama.

BOCAS DEL TORO: region of Almirante, *Cooper* 407; Changuinola Valley, *Dunlap* 234; vicinity of Chiriquí Lagoon, *von Wedel* 1215; Water Valley, *von Wedel* 608, 1777, 2660; Shepherd Island, *von Wedel* 2679—this specimen is more rugose than usual. CANAL ZONE: Río Pedro Miguel, near East Paraiso, *Standley* 29966; around El Paraiso, alt. 30-100 m., *Pittier* 2534; Corozal, *Stevens* 124; *Riley* 138; along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley* 29199; between Miraflores and Corozal, alt. 20-30 m.,

Pittier 2193; Las Cascadas Plantation, near Summit, *Standley* 25692, 25701, 26012; Summit, *Standley* 26937; Cerro Gordo, near Culebra, *Standley* 25998; Balboa, *Standley* 26073, 29267; Gamboa, *Standley* 28522; Empire, *Miller* 1869; Empire to Mandinga, *Piper* 5514; vicinity of Ancón, *Piper* 6028; *Bro. Celestine* 32; Rio Agua Salud, near Frijoles, *Piper* 5867; near Rio Medio, Madden Dam Road, *Miller* 1768, 1769, 1771, 1802; vicinity of Madden Dam, near Rio Chagres, alt. 50-75 m., *Seibert* 549; near old Fort Lorenzo, mouth of Rio Chagres, *Piper* 5971. COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), alt. 10-104 m., *Pittier* 4083. PANAMÁ: Sabana de Juan Corso, near Chepo, alt. 60-80 m., *Pittier* 4537; along the Corozal Road, near Panamá, *Standley* 26843; Juan Diaz, *Standley* 30623; Rio Tapia, *Standley* 28134; 3 miles east of Juan Diaz, alt. 75 m., *Killip* 3123; Bella Vista, *Macbride* 2732; Camino de La Granja, *Bro. Heriberto* 165. DARIÉN: near mouth of Rio Yapé, alt. 20 m., *Allen* 351.

48a. *PIPER VILLIRAMULUM* var. *GAMBOANUM* (C.DC.) Trel. in Contr. U. S. Nat. Herb. 26:36. 1927.

Piper gamboanum C.DC. in Candollea 1:249. 1923.

Piper hispidum Sw. var. *gamboanum* C.DC. in Smiths. Misc. Coll. 71⁶:12. 1920.

Piper gamboanum var. *yapense* Trel. in Ann. Mo. Bot. Gard. 27:291. 1940.

Leaves 2-4 or occasionally up to 4.5-5 cm. wide.

Occurs with the species.

CANAL ZONE: around Gamboa, alt. 20-100 m., *Pittier* 3410; Corozal, *Stevens* 116, 117; foot of Corozal Hill, *Miller* 1788; along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley* 29048; Las Cascadas Plantation, near Summit, *Standley* 29639; Obispo, *Standley* 31794. PANAMÁ: near the big swamp, east of Rio Tecumen, *Standley* 26598; between Las Sabanas and Matías Hernández, *Standley* 31818. DARIÉN: vicinity of Yapé, *Allen* 854.

The appressed-villous, scabrous, bullulate leaves, and short, stout peduncles characterize this species and distinguish it from *P. tabogatum* in which the leaves are less scabrous, scarcely bullulate, more densely hairy, and with longer peduncles. The young spikes of *P. tabogatum* are also usually very short and bristly from the erect bract hairs. The type of *P. yapeanum* is reported as a tree 15 m. tall. The type specimen agrees in all other respects with those reported as being much smaller plants.

49. *PIPER TABOGANUM* C.DC. in Smiths. Misc. Coll. 71⁶:4. 1920.

Piper obaldianum C.DC. loc. cit. 7. 1920.

Piper dumeticola C.DC. var. *panamense* C.DC. loc. cit. 1920.

Piper pallidibracteum C.DC. loc. cit. 8. 1920.

Piper salinasanum C.DC. var. *parvifolium* C.DC. in Ann. Conserv. & Jard. Bot. Genève 21:234. 1920.

Piper barbinerve Trel. in Contr. U. S. Nat. Herb. 26:35. 1927.

Piper Bigelovii Trel. loc. cit. 23. 1927.

Piper subdilatatum Trel. loc. cit. 35. 1927.

Piper chagresianum Trel. loc. cit. 37. 1927.

Piper breve C.DC. in Trel. loc. cit. 38. 1927.

Piper breve var. *pallidineurum* Trel. loc. cit. 1927.

Piper breve var. *pseudo-dumeticola* Trel. loc. cit. 1927.

Piper breve var. *bellae-vistae* Trel. loc. cit. 39. 1927.

Piper breve var. *divaricatum* Trel. loc. cit. 1927.

Piper breve var. *pseudo-fatoanum* Trel. loc. cit. 1927.

Piper cayazasense Trel. in Ann. Mo. Bot. Gard. 25:826. 1938.

Piper amphibium Trel. loc. cit. 27:288. 1940.

Piper insulicolum Trel. loc. cit. 293. 1940.

Piper tabernillanum Trel. var. *anconense* Trel. loc. cit. 298. 1940.

Piper tembladorense Trel. in Ll. Williams, Expl. Bot. Guyana Venez. 177. 1942 (Serv. Bot. Minist. Agr. y Cria).

A shrub, mostly 1–3 m. tall; upper internodes rather short and slender, soft-villous, crisp-pubescent, or subhispid, more or less canescent; leaves rhombic-subobovate, elliptic, or less commonly lance-elliptic, mostly 4–6 cm. wide \times 10–15 cm. long, or occasional leaves up to 9 \times 22 cm., apex acuminate, narrowed downward to the inequilaterally rounded base, one side commonly 2–5 mm. shorter, the longer side obtuse or cordulate, pinnately nerved from below the middle, the nerves 5–6 or sometimes 7 on each side, often slightly rugescent near the margin or toward the base, crisp-hirtellous or subhispid above with the midrib densely so, somewhat scabrous from the persistent hair bases, soft-pubescent beneath, the nerves usually densely so, the hairs appressed, drying rather thin, translucent; petiole 5–10 or occasionally up to 20 plus 2–5 mm. long, densely hairy, vaginulate commonly to the middle or above, the groove smooth or hairy within; spikes scarcely 1 cm. long when young and more or less bristly from the suberect bract hairs, becoming 3–4 mm. thick \times 4–10 cm. long, commonly apiculate; peduncle mostly 5–10 or occasionally up to 20–25 mm. long, pubescent; bracts rounded or triangular-subpeltate, marginally fringed, the hairs rather stiff, those on the dorsal margin usually longer and suberect in young spikes; fruit oblong-subtrigonous, glabrate or slightly papillate when young; stigmas small, sessile.

Northern South America and Panama.

PANAMÁ: without locality, *Bigelow* s. n.; *Née* 358, 365. CHIRIQUÍ: Boquete District, Boquete, alt. 1140 m., *Davidson* 617. VERAGUAS: trail between Cañazas and the foot of the Cordillera Central, headwaters of Río Cañazas, alt. 300–600 m., *Allen* 185. COCLE: vicinity of Olá, alt. 100–350 m., *Pittier* 5034; El Valle de Antón and vicinity, alt. 500–700 m., *Seibert* 436; El Valle, *Miller* 1818, 1819—small-leaved specimens—1820; between Aguadulce and Antón, alt. 15–50 m., *Woodson*, *Allen* & *Seibert* 1222; vicinity of Santa Clara beach, *Woodson*, *Allen* & *Seibert* 1705; between Las Margaritas and El Valle, *Woodson*, *Allen* & *Seibert* 1306, 1728. CANAL ZONE: Empire, *Miller* 1864, 1869; Empire to Mandinga, *Piper* 5523; near old Fort Lorenzo, mouth of Río Chagres, *Piper* 5944; between Chagres Batteries and Fort San Lorenzo, Fort Sherman Reservation, *Maxon* & *Valentine* 6986; vicinity of Fort Sherman, *Standley* 30918, 30982, 31149; western slope of Ancón Hill, vicinity of Balboa, alt. 20–75 m., *Seibert* 118, 119, 399; *Woodson*, *Allen* & *Seibert* 1327; *Standley* 25203, 26382, *Killip* 12078; Balboa, *Standley* 25420, 25603, 25565; 2 miles west of Balboa, *Correll* 12261; Las Sabanas, *Bro.* *Celestine* 110; *Riley* 116; *Cocli*, *Riley* 127; Matachin, *Cowell* 204; foot of Corozal Hill, *Miller* 1791; Corozal, *Standley* 27341; near Fort Randolph, *Standley* 28659; *Maxon* & *Harvey* 6504, 6543; Fort Kobe road, *Woodson*, *Allen* & *Seibert* 1412; Brazos Brook Reservoir, *Stevens* 752; Culebra, *Stevens* 993; alt. 50–150 m., *Pittier* 3445; around Gamboa, in thickets, alt. 40–80 m., *Pittier* 3709; *Standley* 28374, 28481; between Gamboa and Cruces, alt. 50–80 m., *Pittier* 3787; France Field, *Stevens* 981; Margarita Swamp, south of France Field, *Maxon* & *Valentine* 7055; between France Field, Canal Zone and Catival, Colón, *Standley* 30164; Mount Hope Cemetery, *Standley* 28776; Obispo, *Standley* 31764; Juan Mina, *Piper* 5692; Cerro Gordo, near Culebra, *Standley* 25975, 26018; Chivi-Chivi Trail, 2 miles above Red Tank, *Maxon* & *Harvey* 6591. COLÓN: Chagres, *Fendler* 268; Río Culebra, above Santa Isabel, *Pittier* 4148; Río Indio de Fató, near sea-level, *Pittier* 4271; along the beach between Fató and Playa de Damas, *Pittier* 3923, 3930. PANAMÁ: near Matias Hernández, *Standley* 28957;

near Las Sabanas, Standley 40779; between Las Sabanas and Matias Hernández, Standley 31832; Río Tapia, Standley 28103; near Tapia River, Juan Díaz Region, Maxon & Harvey 6620, 6626; Sabana de Juan Corso, near Chepo, alt. 60-80 m., Pittier 4539; Río Tecumén, Standley 29451; near big swamp east of Río Tecumén, Standley 26551; near Punta Paitilla, Standley 26303; Stevens 349; Juan Díaz, Standley 30637; Tumba Muerto Road, near Panamá, Standley 29724; Bella Vista, at sea-level, Killip 12045, 12004; *Piper* 5331; vicinity of Juan Franco Race Track, near Panamá, Standley 27713, 27734, 27777; Taboga Island, Woodson, Allen & Seibert 1527; Standley 27019, 27920; Miller 1845, 1846—a large-leaved specimen—1847; alt. 90 m., Collenette 487; Killip 3194; Pittier 3529; Taboguilla Island, Miller 2003; Perlas Archipelago, San José Island, Johnston 687, 1019, 1404; Erlanson 376—this specimen differs in having more elliptic-ovate leaves scarcely narrowed toward the base, but it agrees very well in other characters; Trapeche Island, Miller 1908, Allen 2618; Saboga Island, Miller 1951—a large-leaved specimen—1952. SAN BLAS: forests around Puerto Obaldía, alt. 0-50 m., Pittier 4366, 4396—a large-leaved specimen. DARIÉN: Chepigana District, Caña-Cuasi Trail, alt. 600 m., Terry & Terry 1428.

This species is one of the most common in Panama where it occurs in a great variety of scarcely differentiable forms. It appears to be rather closely related to *P. mollicomum* of Brazil, from which it differs, however, because of its mostly less venulose and more finely rugescent leaves which have the margins less rounded below the middle, and with generally shorter peduncles. The type specimen of *P. mollicomum* has not been examined by the writer and the above contrast is based on notes and sketches made by the late Professor Trelease from specimens in European herbaria. There is a considerable range in size and amount of pubescence shown by the leaves, often on the same specimen. The contrast between large-leaved and small-leaved specimens is very great. Other specimens, however, show intergradations in size to such an extent that it does not seem advisable to establish or maintain varieties based on this character alone. The type of *P. Bigelovii* is a rather poor specimen which appears to agree well with this species although it is somewhat more tomentose than usual for most of the specimens included.

50. *PIPER PSEUDOCATIVALENSE* Trel. in Contr. U. S. Nat. Herb. 26:34. 1927.

Shrub, 2 m. tall; flowering internodes rather slender and somewhat elongate, crisp-pubescent; leaves elliptic or elliptic-ovate, apex bluntly short-acuminate, mucronate, base inequilaterally rounded, cordulate, larger leaves strongly so, equal at the petiole or one side about 2 mm. shorter, mostly 5-6 cm. wide \times 10-13 cm. long, pinnately nerved from the lower half, the nerves 4-5 on each side, with cross-connecting-anastomosing nervules, scabrous, crisp-hairy on both sides, the nerves more densely so, the hairs on the nerves beneath upcurved, drying papery, translucent; petiole about 10 plus 2 mm. long, crisp-pubescent, vaginate to the middle or above; spikes as yet very young, bristly with the erect bract hairs; peduncle pubescent; ovary or fruit not developed.

Known only from the following locality.

COLÓN: France Field, Canal Zone, and Catival, Standley 30399.

The elliptic or somewhat ovate leaves, hairy on both sides, and with the base rounded-cordulate on both sides, and bristly young spikes distinguish this species. It is apparently closely related to *P. tabogatum* but differs because of the shape of the leaf, and more rounded cordulate base.

51. *PIPER LUCIGAUDENS* C.DC. in Smiths. Misc. Coll. 71⁶:10. 1920.*Piper pseudo-viridicaule* Trel. in Ann. Mo. Bot. Gard. 27:296. 1940.

A shrub or small tree, up to 3-4 m. tall, nodose; flowering internodes somewhat zigzag, slender and rather short, granular, sparingly crisp-pubescent; leaves elliptic or elliptic-ob lanceolate, the midrib somewhat nearer one side, apex narrowly attenuately acuminate, base inequilateral, one side 2-5 mm. shorter, acute or the longer side more rounded and obtusish, 4-6 cm. wide \times 13-17 cm. long, somewhat scabrous, pinnately nerved from the lower half, the nerves 4-5 on each side, with cross-connecting-anastomosing nervules, glabrous above, hirsute along the nerves beneath, the hairs suberect, mostly 0.5 mm. or more long, drying papery, green above, paler and glandular-dotted beneath, translucent; petiole about 5 plus 2-5 mm. long, somewhat hirsute, vaginate at the base; spikes as yet young, 2-3 mm. thick \times 8-10 cm. long, peduncle up to 1 cm. long, granular, glabrous; bracts rounded- or triangular-subpeltate, narrowly and sparsely fringed; ovary or fruit not developed.

Panama.

CANAL ZONE: forest along the Río Indio de Gatún, near sea-level, *Pittier* 2791, 2791a; near Río Medio, *Miller* 1766; Barro Colorado Island, *Standley* 31288, 31387.

51a. *PIPER LUCIGAUDENS* var. *Allenii* (Trel.) Yuncker, comb. nov.*Piper Allenii* Trel. in Ann. Mo. Bot. Gard. 25:826. 1938, not C.DC. 1910.

Tree 7 m. tall; flowering internodes more densely subhispid; leaves somewhat larger, hairs beneath on midrib appressed, less than 0.5 mm. long.

Known only from the type locality.

DARIÉN: trail between Pinogana and Yavisa, alt. 15 m., *Allen* 270 (Herb. Univ. Ill., TYPE)—"Roots used by Indians to deaden pain, leaves used as snake bite remedy."

The specimen upon which *P. pseudo-viridicaule* was based is sterile. It agrees very well in its vegetative characters with the others included here, and it is believed to be the same.

52. *PIPER STORKII* Trel. in Contr. U. S. Nat. Herb. 26:32. 1926.

Shrub (?), nodose, nearly glabrous; flowering internodes slender and short, granular, sparsely pubescent when young; leaves elliptic or lance-elliptic, the midrib nearer one side, apex attenuately acuminate, base strongly inequilateral, one side 2-3 mm. shorter, acute, the longer side rounded, obtuse, pinnately nerved from the lower half, the nerves 4-5 on each side, approximated downward, with cross-connecting-anastomosing nervules, 4-5 cm. wide \times 14-16 cm. long, glabrous and somewhat scabrid above, very obscurely appressed-pubescent beneath, at least along the nerves, drying thin, green, translucent; petiole about 5 plus 2-3 mm. long, granular, glabrous, vaginate at the base; spikes as yet young, 2 mm. thick \times 6 cm. long; peduncle scarcely 5 mm. long, stout, glabrous; bracts triangular-subpeltate, glabrous or with a few, short, ventral hairs; ovary and fruit not matured.

Known only from Bocas del Toro.

BOCAS DEL TORO: Rubber Tree Station, *Stork 124*.

The thin, nearly glabrous leaves, and essentially glabrous bracts characterize this species.

53. *PIPER WAGNERI* C.DC. in DC. *Prodr. 16¹:302. 1869.*

Piper minutispicum C.DC. in Smiths. *Misc. Coll. 71⁶:1. 1920.*

Piper Wagneri var. *minutispicum* Trel. in *Contr. U. S. Nat. Herb. 27:29. 1927.*

A glabrous, nodose shrub; upper internodes relatively short and slender; leaves lance- or ovate-elliptic, apex moderately acuminate, base subequilateral, the margin equal at the petiole or with one side commonly 1-5 mm. shorter, acute or occasionally with the longer side subcordulate, 4-7 cm. wide \times 10-14 cm. long, pinnately nerved from below the middle, the nerves 3-5 on each side, with fine, cross-connecting-anastomosing nervules, glandular-dotted beneath, drying rather papery, translucent; petiole 10-25 plus 1-5 mm. long, vaginate to the blade; spikes up to 4 mm. thick \times 9 mm. long, mucronate; peduncle 5-8 mm. long; bracts concave-inflexed, glabrous; ovary glabrous, stigmas sessile.

Southwestern Panama.

CHIRIQUI: *Wagner*; oak-palm forest above Sabana de El Salto, above El Boquete, alt. 1500-1750 m., *Pittier 3116*.

DeCandolle described *P. minutispicum* as dioecious. The spikes on the type are very young and, as in young spikes generally, the ovary is scarcely developed. It is believed that specimens with mature spikes will show that the flowers are perfect. Otherwise, the types of *P. Wagneri* and *P. minutispicum* appear to be the same species. The glabrous stems and leaves and very short spikes are distinctive characters.

54. *PIPER DUNLAPI* Trel. in *Contr. U. S. Nat. Herb. 26:23. 1927.*

Shrub (?), nodose, glabrous; flowering internodes rather short and slender, glandular-dotted; leaves ovate or lance-ovate, apex gradually sharp-acuminate, base inequilateral, acute, or equilaterally rounded and obtuse, 3.5-5.5 cm. wide \times 10-13 cm. long, pinnately nerved from below the upper third, the nerves about 4-5 on each side, with faint cross-connecting-anastomosing nervules, strongly glandular-dotted on both sides, drying rather thick, narrowly revolute, subtranslucent, glossy above, dull beneath; petiole 1-1.5 cm. long, vaginate at the base, or on larger leaves to the blade; spikes as yet immature, somewhat curved, apiculate, 3 mm. thick \times 2-3 cm. long; peduncle slender, scarcely 1 cm. long; bracts round- or subquadangular-subpeltate, densely yellow-fringed, the fringe hairs filiform; ovary and fruit not developed.

Known only from the following locality.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 231*.

The glabrous stems and leaves, short spikes, and densely yellow-fringed bracts distinguish this species. It resembles *P. birtellipetiolum* var. *subtrinerve* to a considerable extent but differs because of its more rounded floral bracts which are scarcely umbonate when young, and with more filiform fringe hairs. The Gray Herbarium specimen, obviously the same collection as that of the type in the U. S. National Herbarium, has scarcely glandular-dotted leaves.

55. *PIPER PALMASANUM* C.DC. in Smiths. Misc. Coll. 71⁶:3. 1920.

A shrub; flowering internodes moderately slender, elongating downward, from very sparingly soft-pubescent quickly glabrescent; leaves ovate-lanceolate, apex gradually sharp-acuminate, base subequilaterally rounded or with one side 1-2 mm. shorter at the petiole, obtuse or abruptly acutish at the petiole, 3-5.5 cm. wide \times 10-15 cm. long, pinnately nerved from below the middle, the nerves about 4 on each side, gradually closer together downward, impressed above, raised beneath, with cross-connecting-anastomosing nervules, glabrous above, the nerves beneath appressed-hairy, obscurely glandular-dotted beneath, drying firm, subtranslucent; petiole 5-15 mm. long, sparsely pubescent glabrescent, vaginate-winged to the middle; spikes yellow, as yet young, 2 mm. thick \times 2 cm. long, mucronate; peduncle 5-10 mm. long, sparsely pubescent; bracts triangular-subpeltate, yellow-fringed; ovary and fruit not developed.

Known only from Cuesta de Las Palmas, Chiriquí.

CHIRIQUÍ: humid forest of Cuesta de Las Palmas, southern slope of Cerro de la Horqueta, alt. 1700-2100 m., Pittier 3225.

The relatively small, yellow spikes, and the character of the pubescence characterize this species.

56. *PIPER REPTABUNDUM* C.DC. in Bot. Gaz. 70:169. 1920.

"Repent or scandent," glabrous; flowering internodes slender and short, granular-scurfy; leaves strongly inequilaterally, somewhat falcately, oblong-elliptic, the margin on one side quite straight and subparallel with the midrib to near the apex, the other side strongly curved from the base to the tip, apex sharply acuminate, base inequilateral with one side about 2 mm. shorter, the longer side obtuse or cordulate-auriculate and covering the petiole, 3.5-5.5 cm. wide \times 13-20 cm. long, pinnately nerved from below the upper third, the nerves 4-6 on each side, strongly curved toward the apex, with strong cross-connecting veinlets and finely nervulose with anastomosing nervules, finely granular beneath, drying rather firm, translucent; petioles nearly obsolete, 1-2 plus 2 mm. long, scurfy; spikes 2 mm. thick \times 4-8 cm. long, somewhat curved; peduncle slender, 4-7 cm. long; bracts small, triangular-subpeltate, smooth or granular-papillate; fruit obpyriform-trigonous, granular-papillate; stigmas sessile.

Costa Rica and adjacent Panama.

BOCAS DEL TORO: Sibubi Falls, Sixaola Valley, Rowlee & Rowlee 392 (Cited as 372 by Trelease in Contr. U. S. Nat. Herb. 26:38. 1927).

The subarcuate leaf shape and very long peduncles strongly characterize this species.

57. *PIPER CHIRIQUINUM* C.DC. in Smiths. Misc. Coll. 71⁶:2. 1920.*Piper paso-anchense* Trel. in Ann. Mo. Bot. Gard. 27:295. 1940.

A shrub, 2-3 m. tall, glabrous, nodose; flowering internodes rather slender and short, smooth or with round lenticels; leaves ovate or lance-ovate, apex bluntly acuminate, base mostly rounded, acute or obscurely and shallowly cordate, abruptly contracted onto the petiole, 3.5-8 cm. wide \times 8-14 cm. long, pinnately nerved from below the upper third, the nerves 3-4 on each side in small leaves or 4-5 in larger leaves, with 2 or 3 pairs from near the base and 1 or 2 pairs above, with a few shorter intermediates and cross-connecting-anastomosing nervules, drying firm, pale green, translucent; petiole 10-25 mm. long, vaginate at the base or occasionally to about the middle; spikes 2-3 mm. thick \times 5-8 cm. long, usually mucronate; peduncle 5-10 mm. long; bracts rhomboid-subpeltate, umbonate, submarginally ciliolate; fruit obpyramidal-trigonous, glabrous, stigmas sessile.

Panama.

CHIRIQUÍ: pastures around El Boquete, alt. 1000-1300 m., Pittier 2930; Maxon 4944; Davidson 725; forests along the Río Ladrillo and vicinity, above El Boquete, alt. 1200-1300 m., Maxon 5557, 5558; trail from Paso Ancho to Monte Lirio, upper valley of Río Chiriquí Viejo, alt. 1500-2000 m., Allen 1579.

This species bears some resemblance to *P. aequale* from which it is to be distinguished, however, because of the leaf shape and type of venation. The type of forma *b* has smaller leaves but the range in size of leaves on the different specimens is so great that it is not believed that it merits recognition.

58. *PIPER TENUIMUCRONATUM* C.DC. in Smiths. Misc. Coll. 71⁶:12. 1920.

A glabrous shrub, 1-3 m. tall; flowering internodes slender and rather short, pale-granular or glandular-dotted downward; leaves lance-ovate or elliptic, apex attenuately rather long-acuminate, commonly bristle-pointed, base subequilaterally acute, 3-5.5 cm. wide \times 8-12 cm. long, pinnately nerved from below the middle, the nerves 3-4 on each side, with cross-connecting-anastomosing nervules, finely granular- or glandular-dotted beneath, drying green above, paler beneath, rather thin, translucent; petiole 10-15 mm. long, vaginate at the base only; spikes 3 mm. thick \times 4-7 cm. long, apiculate; peduncle 1-2 cm. long; bracts triangular- or lunulate-subpeltate, margin conspicuously white-fringed; fruit globose or ovoid, laterally somewhat compressed; stigmas 3, sessile.

Panama.

CHIRIQUÍ: humid forest around Los Siguas Camp, southern slope of Cerro de la Horqueta, alt. about 1700 m., Pittier 3185; Maxon 5421; Bajo Chorro, Boquete District, alt. 1800 m., Davidson 321, 719; forest along the Río Ladrillo and vicinity, about El Boquete, alt. 1200-1300 m., Maxon 5395; Monniche Trail, Chiriquí Volcano, alt. 1700 m., Killip 3523.

The shape, rather prominent bristle tips, and nervation of the leaves characterize this species.

59. *PIPER SEPTUPLINERVUM* (Miq.) C.DC. in DC. Prodr. 16¹:313. 1869.*Artanthe septuplinervia* Miq. in Seem. Bot. Voy. Herald, 199, pl. 40. 1854.

Shrub (?), glabrous, strongly nodose; flowering internodes short and slender, smooth or somewhat scurfy-granular; leaves lance- or oblong-ovate, apex rather long and sharply acuminate, base equilateral, rounded, obtuse, 3-4.5 cm. wide \times 9-12 cm. long, pinnately nerved below the upper third, the nerves 4-5 on each side, prominent beneath, with fine cross-connecting-anastomosing nervules, drying pale green, firm, narrowly revolute, scarcely glandular-dotted; petiole about 5 mm. long, channelled above, vaginate at the very base only; spikes 4 mm. thick \times 3-4 cm. long when mature; peduncle 5-10 mm. long; bracts round-subpeltate, glabrous in the center, marginally somewhat ciliate; fruit obpyramidal-trigonous, puberulous toward the top, stigmas 3, sessile.

Panama.

PANAMA: without location, Seemann 1066. COLÓN: forests around Porto Bello, alt. 5-100 m., Pittier 2477.

59a. *PIPER SEPTUPLINERVUM* var. *subpubinervium* Yuncker, var. nov.

Foliis 4.5-5 cm. latis, 12 cm. longis, luteo-glandulosis, venis supra puberulentis subtus glabratibus; bracteis triangulari-subpeltatis, margine luteo-fimbriatis.

Leaves 4.5-5 cm. wide \times 12 cm. long, yellow-glandular-dotted, nerves above puberulent, glabrous beneath; bracts triangular-subpeltate, marginally yellow-fringed.

Known only from the type locality.

PANAMA: without locality, 1859-1860, Hayes 783 (no 678 also on the bottom of label) (Herb. New York Bot. Gard., TYPE).

The glabrous, strongly nodose twigs, and glabrous, round-based leaves characterize this species which appears to be rather closely related to *P. aequale*.

60. *PIPER SUBQUINQUENERVE* Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:363. 1937.

A shrub (?), nodose, essentially glabrous; flowering internodes slender and short; leaves lance-elliptic, apex acuminate, base subequilateral, acute, 2.5-3 cm. wide \times 8-10 cm. long, pinnately nerved from the lower half, the nerves 3 on each side, long-ascending, connected with the midrib with cross-connecting nervules, commonly with two pair near the base and the third pair arising at about the middle, yellowish and microscopically puberulent glabrescent beneath, drying rather thin and dull, translucent; petiole 5-12 mm. long, grooved above but vaginate only at the very base; spikes as yet young, 2 mm. \times 3.5 cm. long; peduncle about 1.5 cm. long; bracts round-subpeltate, smooth above; ovary and fruit not developed.

Known only from the following locality.

BOCAS DEL TORO: Changuinola Valley, Dunlap 452.

61. *PIPER INFRALUTEUM* Trel. in Contr. U. S. Nat. Herb. 26:33. 1927.

A glabrous shrub; flowering internodes slender and short; leaves lance-elliptic or somewhat oblong, apex acuminate, base inequilateral with one side 2-3 mm. shorter, acute, 3-4 cm. wide \times 10-12 cm. long, pinnately nerved from the lower half, the nerves slender, 4-5 on each side, with fine cross-connecting-anastomosing nervules, glandular-dotted on both sides, drying yellow beneath; petiole 5-7 plus 2-3 mm. long, vaginate at the base; spikes 2 mm. thick \times 4-5 cm. long; peduncle about as long as the petioles; bracts round- or triangular-subpeltate, strongly yellow-fringed; ovary subglobose, smooth, stigmas slender, sessile.

Panama.

PANAMA: without locality, Hayes 793.

62. *PIPER CRICAMOLENSE* Trel. in Ann. Mo. Bot. Gard. 27:290. 1940.

A brittle, somewhat nodose shrub, 2-3 m. tall; flowering internodes short and relatively slender, microscopically strigulose especially about the nodes, quickly glabrescent; leaves elliptic or elliptic-obovate, apex abruptly sharp-acuminate, base subequilateral, obtuse, 4-7 cm. wide \times 9-13 cm. long, pinnately nerved from below the middle, the nerves 4-5 on each side, strongly curved and unbranched upward, salient beneath, with conspicuous cross-connecting nervules, finely nervulose by transmitted light, glabrous on both sides or microscopically strigulose along the nerves, obscurely glandular-dotted beneath, drying papery, translucent; petiole scarcely 5 mm. long, microscopically strigulose, vaginate at the base only; spikes 2-3 mm. thick \times 5-7 cm. long; peduncle 5 mm. long, rather stout, glabrous or microscopically strigulose; bracts triangular-subpeltate, marginally densely yellow-fringed; ovary narrowly ovoid-trigonous, yellow-glandular; stigmas 3, slender, sessile.

Known only from the following locality.

BOCAS DEL TORO: Rio Cricamola, between Finca St. Louis and Konkintoe, alt. 10-50 m., Woodson, Allen & Seibert 1927.

The more or less microscopically strigulose twigs, low branching of the midrib, densely yellow-fringed bracts, and ovoid ovary characterize this species.

63. *PIPER AEQUALE* Vahl, Eclog. Amer. 1:4, pl. 3. 1796.

Schilleria aequalis Kunth, in Linnaea 13:687. 1839.

Artanthe aequalis Miq. Syst. Pip. 511. 1844.

?*Piper Funci* C.DC. in DC. Prodr. 16:310. 1869.

Piper substenocarpum C.DC. in Bull. Herb. Boiss. 6:492. 1898.

Piper concinnum C.DC. var. *trinitense* C.DC. in Urb. Symb. Ant. 3:304. 1902.

Piper Johnstoni C.DC. in Proc. Amer. Acad. 40:685. 1905.

Piper caledonianum C.DC. in Fedde. Rep. Sp. Nov. 15:1. 1917.

Piper aequale var. *substenocarpum* C.DC. in Ann. Conserv. & Jard. Bot. Genève 21:253. 1920.

Piper amphioxys Trel. in Contr. U. S. Nat. Herb. 26:31. 1927.

Piper ibaguense Trel. in Trab. Mus. Nac. Hist. & Jard. Bot. Madr. Ser. Bot. 33:50. 1936.

Piper zediogodiense Trel. ex Ll. Williams, Expl. Bot. Guyana Venezol. 177. 1942.

A glabrous, nodose shrub, 1-3 m. tall; flowering internodes slender and comparatively short; leaves elongated-elliptic, lance-elliptic or ovate, $3.5-9 \times 12-17$ cm. long, apex more or less attenuate, bluntly acuminate, base equilaterally acute or obtusish, pinnately nerved to the upper third or nearly throughout, the nerves mostly 4-5 or 6 on each side, with fainter intermediates and cross-connecting-anastomosing nervules, commonly 2 or 3 pairs approximated near the base and 1 or 2 pairs above the middle of the blade, the nerves often golden in dry specimens, drying rather firm, somewhat glossy, narrowly revolute, translucent; petiole about 5-10 mm. long or sometimes up to 1.5 cm. on lower leaves, commonly vaginate near the base but occasional leaves vaginate to the middle or above; spikes 2-4 mm. thick and up to 10 cm. long; peduncle commonly about as long as the petiole; bracts rounded dome-shaped when young with submarginal fringe, becoming round- or triangular-subpeltate and loosely fringed; fruit small, obpyramidal-trigonous, convex at the top, glabrous; stigmas slender, sessile.

West Indies, northern South America, and Panama.

CANAL ZONE: Barro Colorado Island, *Bailey & Bailey* 495. COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), alt. 10-104 m., *Pittier* 4239.

63a. *PIPER AEQUALE* var. *laurifolium* (Trel.) Yuncker, comb. nov.

Piper amphioxys Trel. var. *laurifolium* Trel. in *Contr. U. S. Nat. Herb.* 26:31. 1927.

The nerves beneath very minutely hirtellous; the leaves mostly with 3 strongly ascending nerves on each side with two from near the base and the third from near or above the middle.

Known only from the type locality.

DARIÉN: foothills of Garagará, Sambú basin, alt. 300-500 m., *Pittier* 5598 (U. S. Nat. Herb., TYPE).

This species appears to be widely distributed in tropical America. The Panamanian specimens here cited agree in all respects with those from South America and the West Indies believed to represent this species.

64. *PIPER SAMBUANUM* C.DC. in *Smiths. Misc. Coll.* 71⁶:13. 1920.

A shrub (?), nodose, glabrous; flowering internodes slender and short, obscurely granular and glandular-dotted; leaves lance-elliptic to obliquely lanceolate, apex acuminate, base inequilateral with one side about 2 mm. shorter, obtuse or the longer side subcordulate, $5-6.5 \times 13-17$ cm. wide \times 13-17 cm. long, pinnately nerved from below the upper third, the nerves about 4 on each side, or 5 with the lower-most obscure, with rather strong cross-connecting-anastomosing nervules, glandular-dotted, drying papery, translucent, pellucid-dotted; petiole about 3 plus 2 mm. long, stout, vaginate-winged to the lower blade margin; spikes 2 mm. thick \times 8-10 cm. long; peduncle scarcely 1 cm. long, stoutish; bracts small, round- or triangular-subpeltate, marginally ciliolate; ovary glabrous; stigmas sessile; fruit not developed.

Known only from Sambú basin, Darién.

DARIÉN: foothills of Garagará, Sambú basin, alt. 30-500 m., *Pittier* 5663, 5726.

The glabrous, glandular-dotted, nodose twigs, short-petioled leaves, and slender spikes characterize this species.

65. *PIPER TECUMENSE* Trel. in Contr. U. S. Nat. Herb. 26:29. 1927.

A shrub, scarcely 2 m. tall, essentially glabrous; flowering internodes slender and elongating downward, glabrous or very slightly evanescently crisp-pubescent, slightly pubescent at the nodes; leaves elliptic, elliptic-ovate, or lance-ovate, apex gradually sharp-acuminate, base nearly equilateral, rounded, one side commonly about 2 mm. shorter, pinnately nerved from the lower half, the nerves about 4 on each side, submarginally loop-connected, with cross-connecting-anastomosing nervules, not glandular-dotted, 4-5.5 cm. wide \times 10-14 cm. long, glabrous above, the nerves beneath obscurely and minutely appressed-pubescent or glabrescent; petiole scarcely 5 plus 2 mm. long, vaginate at the base; stipules and stipular line slightly pubescent; spikes as yet young, 1.5 mm. thick \times 3.5 cm. long; peduncle slender, 1 cm. long, glabrous; bracts rounded-subpeltate, yellow-fringed; ovary and fruit not developed.

Known only from the following locality.

PANAMÁ: Río Tecumen, Standley 29358.

66. *PIPER CRASSISPICATUM* Opiz in Presl, Reliq. Haenk. 1:152. 1830.

Artanthe crassispicata Miq. Syst. Pip. 521. 1844.

A shrub (?), nodose, glabrous; leaves elliptic- or oblong-ovate, apex rather abruptly acuminate, base equilaterally subacute, 10-13 cm. wide \times 20-22 cm. long, pinnately nerved from below the upper fourth, the nerves about 7 on each side, drying subcoriaceous; petiole 1.5-2 cm. long, vaginate-winged downward; spikes 4 mm. thick \times 5-6.5 cm. long; peduncle about 5 mm. long; bracts triangular-subpeltate, ciliate; fruit said to be obpyramidal-triquetous and stigmas sessile.

Known only from the type specimen in the Prague herbarium collected by Haenke.

An obscure species apparently distinguished by the rather large leaves and number of nerves. The type has not been seen. The description is based on notes of the type made by the late Professor Trelease from the specimen at Prague.

67. *PIPER BOGOTENSE* C.DC. in Jour. Bot. 4:214. 1866.

?*Piper fistulosum* C.DC. loc. cit. 212. 1866.

Piper fuscens C.DC. in DC. Prodr. 16¹:291. 1869, not *Artanthe fuscescens* Miq.

Piper durirameum C.DC. in Bull. Herb. Boiss. 6:484. 1898.

Piper tungurabuae Sodiro, Contr. Conoc. Fl. Ecuator. Monogr. 1, 2nd ed. Nuev. Adic. 1. [1902.]

Piper oblitum Trel. in Contr. U. S. Nat. Herb. 26:22. 1927.

Piper bogotense C.DC. var. *usaquemanense* Trel. in Trab. Mus. Nac. Hist. & Jard. Bot. Madr. Ser. Bot. 33:48. 1936.

Piper usaquemense (Trel) Pérez Arbeláez, Pl. Utiles de Col. 207, f. 245. 1947.

A shrub or small tree, up to 8 or 10 m. tall; flowering internodes comparatively short, sparsely pubescent or glabrate; leaves ovate, mostly 6-8 or 9 cm. wide \times 10-15 cm. long, or infrequently up to 15-18 \times 20 cm., apex acuminate, or sometimes rather blunt, base more or less inequilateral with one side often shorter, rounded, obtuse, cordate, or acute, pinnately nerved from the lower third, the major nerves 3 or 4 or in larger leaves 5 on each side, with reduced nerves upward, more or less pubescent above at least along the nerves, often somewhat glossy when dry, from densely crisp-pubescent to subglabrate beneath, but with the nerves mostly persistently rather densely crisp-pubescent, the hairs more abundant on the sides of the nerves, mostly densely ciliolate, glandular-dotted, drying rather dark, firm, translucent; petiole 1-1.5 or 2 cm. long, or on lower leaves up to 5 cm., mostly densely crisp-pubescent-tomentose, vaginate at the base; spikes 5-7 mm. thick and up to 8 cm. long but mostly somewhat shorter; peduncle about 10 mm. long, thinly crisp-pubescent glabrescent; bracts round- or triangular-subpeltate, marginally fringed; fruit obovoid, stigmas 3-4, lanceolate, recurved, sessile.

Northern South America and Panama.

PANAMA: without location, Hayes 803.

It has been impossible to find any differences between this specimen from Panama and those believed to represent *P. bogotense* from South America.

68. *PIPER SPERDINUM* C.DC. in Smiths. Misc. Coll. 71⁶:1. 1920.

A low shrub; flowering internodes relatively short, densely villous with a mixture of scattered hairs up to 2 mm. or more long; leaves inequilaterally elliptic or subovate, the midrib much nearer one side, apex sharp and long-acuminate, base strongly inequilateral with one side 1-3 mm. shorter at the petiole and rounded-cordulate, the longer side auriculate, the lobe 1-2 cm. long and covering the petiole, 6-9 or 10 cm. wide \times 15-24 cm. long, pinnately nerved from below the middle, the nerves mostly 4-5 on each side, prominent beneath and with rather prominent cross-connecting-anastomosing nervules, submarginally loop-connected, glabrous above except for a few hairs on the midrib near the base, pubescent beneath with the nerves densely so with an intermixture of spreading long hairs, margin not ciliate, obscurely glandular-dotted, drying rather papery, translucent; petiole about 3-5 plus 1-3 mm. long, densely hairy, vaginate at the base; spikes about 3 mm. thick \times 6-7 cm. long, with a slender, bearded, aristate tip up to 1 cm. long; peduncle up to 2 cm. long, densely pubescent; bracts truncately triangular-subpeltate, with usually 2-4 rather prominent dorsal setae, or glabrous, the pedicel margins setose; rachis ridges fimbriate; fruit obpyriform-trigonous, granular-papillate, stigmas slender, sessile.

Near Puerto Obaldia, San Blas Coast.

SAN BLAS: hills back of Puerto Obaldia, alt. 50-200 m., Pittier 4301, 4348.

A very well-marked species with its dimorphic pubescence, auriculate leaves, and papillate fruit.

69. **PIPER PERBREVICAULE** Yuncker, sp. nov.

Suffrutex, ca. 15 cm. altus, caudice conferte villosa, pilis 1-2 mm. longis; foliis rhombico-elliptico-ovobatis, apice abrupte breviter acuminatis, basi inaequaliter subcordato-auriculatis, lobo longiore petiolum obtegente, utrinque longe villosis, pilis 1 mm. vel ultra longis, subtus ad venas patentibus, a medio infero pinnatim venosis, venis 4 + 5-6; petiolo haud 1 cm. longo, dense longe villosa, sub base vaginato; spicis 1-2 mm. crassis, 3 cm. longis; pedunculo 3-5 cm. longo, dissite villosa; bracteis triangulari-subpeltatis, glabratris; drupa ovoideo-subglobosa subacuminata; stigmatibus gracilibus sessilibus.

A very small subshrub, 15 cm. or less tall; stem drying somewhat ridged, densely villous, the hairs 1 mm. or more long; internodes mostly 1-2 cm. long; leaves somewhat pustular above, obliquely elliptic-ovate-rhomboidal, the midrib much nearer one side, 2.5-4 cm. wide \times 7-9 cm. long, apex abruptly short-acuminate, base subequal at the petiole, the shorter side obtuse or cordulate, the longer side auriculate with the lobe, about 1 cm. long and covering the petiole, long-villous on both sides, the nerves beneath more strongly so with the hairs essentially erect and 1 mm. or more long, pinnately nerved from the lower half, the nerves 4 + 5-6 with cross-connecting-anastomosing nervules, drying rather thin, green, translucent; petiole scant 1 cm. long, densely long-villous, vaginate toward the base; spikes red, purple, or olive-green when fresh, 1-2 mm. thick \times 3 cm. long; peduncle 3-5 cm. long, slender, sparsely villous glabrescent; bracts triangular-subpeltate, glabrous; fruit very small, ovoid-subglobose with pointed apex, glabrous; stigmas slender, sessile.

Known only from the type locality.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Water Valley, Oct. 1, 1940, von Wedel 971 (Herb. Missouri Bot. Gard., TYPE); Nov. 1, 1940, von Wedel 1469.

69a. **PIPER PERBREVICAULE** var. **subglabrilimbum** Yuncker, var. nov.

Foliis supra glabratris, subtus ad venas haud conferte villosis, pilis haud 1 mm. longis.

Leaves 4.5 cm. wide \times 8-9 cm. long, upper surface of blade glabrous, the nerves beneath thinly villous, the hairs less than 1 mm. long.

Known only from the type locality.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Oct. 8, 1940, von Wedel 1074 (Herb. Missouri Bot. Gard., TYPE).

The very small plants, long-villous stems, and strongly auriculate leaves are distinctive characteristics of this species.



Fig. 9. *Piper perbrevicaule*

70. *PIPER LEPTOCLADUM* C.DC. in Anal. Inst. Fis.-Geogr. Costa Rica 9:164. 1897.*Piper dilatatum* Rich. var. *leptocladum* C.DC. in Candollea 1:96. 1923.*Piper diazatum* Trel. in Contr. U. S. Nat. Herb. 26:34. 1927.*Piper diazatum* var. *viae-kobeanae* Trel. in Ann. Mo. Bot. Gard. 27:290. 1940.*Piper tabernillanum* Trel. loc. cit. 298. 1940.

A shrub, up to about 3 m. tall; flowering internodes slender and rather short, sparsely crisp-hairy; leaves subrhombically elliptic, lanceolate, or subovate, smooth or slightly rugose, occasionally slightly scabrous, apex gradually sharp-acuminate, base rounded, obtuse to cordulate, or subcordate, equal at the petiole or with one side slightly shorter, 4-5 or sometimes 7 cm. wide \times 10-17 cm. long, pinnately nerved from the lower half, the nerves 4-5 on each side, puberulent above along the nerves, rather sparsely appressed- or crisp-pubescent on the nerves beneath, glandular-dotted, drying rather thin, green, translucent; petiole 5-10 mm. long, crisp-villous, vaginate at the base; spikes 3 mm. thick \times 6-9 cm. long; peduncle about 5 mm. long, pubescent or glabrate; bracts triangular-subpeltate, yellow-fringed; fruit obpyramidal-trigonous, glabrous, green to dark-colored, stigmas small, sessile.

Panama and Costa Rica.

CANAL ZONE: vicinity of Fort Sherman, Standley 30953, 30974, 30996; Monte Lirio, Maxon 6843; Matachin to Las Cascadas, Cowell 338; Las Cascadas Plantation, near Summit, Standley 25798, 29625; Fort San Lorenzo, Fort Sherman Military Reservation, Maxon & Valentine 7012—the leaves on this specimen are smaller and less pubescent than customary for this species but it appears to agree in all other characters; Barro Colorado Island, Bailey & Bailey 55, 104, 242; Kenoyer 307, 308; Standley 40862, 41035; Cerro Gordo, near Culebra, Standley 26006; around Tabernilla, along the railroad, alt. 20-25 m., Pittier 3828; Empire, Miller 1765; Mt. Hope Cemetery, Standley 28802; Obispo, Standley 31671; Fort Kobe road, Woodson, Allen & Seibert 1412. COLÓN: forests around Porto Bello, alt. 5-100 m., Pittier 2428. PANAMÁ: Juan Diaz, deep woods, Killip 3114.

This species rather closely resembles *P. dilatatum* of South America but differs because of its glabrous fruit and other minor characters.

71. *PIPER DIMORPHOTRICHUM* Yuncker, sp. nov.

Frutex, 3 m. altus, internodiis floriferis sat brevibus crassisque, conferte subretrorse brunneohirsutis, pilis brevibus longisque intermixtis, pilis longis ad 3-4 mm. vel. ultra longis; foliis late ellipticis, apice attenuatim acuminatis, basi oblique cordulatis vel subauriculatis, lobis subaequalibus vel lobo longiore petiolum fere aequante, a medio infero pinnatim venosis, venis utrinque 5-8, trabibus gracilibus anastomosantibus, supra sparse villosis, subtus pubescentibus (confertibus ad venas), pilis erectis, heteromorphis, brevioribus longioribusque intermixtis; petiolo vix 1 mm. longo, a medio deorsum vaginato;



Fig. 10. *Piper dimorphotrichum*

spicis 5 mm. crassis, 5-6 cm. longis; pedunculo gracili, 4-6 cm. longo, villoso; bracteis triangulari-subpeltatis, margine fimbriatis; drupa oblonga lateraliter compressa, glabrata, glandulosa, stigmatibus sessilibus.

A shrub, up to 3 m. tall; flowering internodes rather short and slender, densely subretrorsely brown-hairy, the hairs of different lengths up to about 1 mm. with intermixed scattered long-spreading hairs up to 3-4 mm. or more; leaves broadly elliptic, apex attenuately acuminate, base obliquely cordulate or subauriculate, sub-equal at the petiole, the lobes subequal or one larger and about as long as the petiole, 5-10 cm. wide \times 15-20 cm. long, pinnately nerved from below the middle, the nerves 5-8 on each side, approximated downward, with prominent, slender, cross-connecting-anastomosing nervules, sparsely villous above, staring pubescent beneath, the nerves more densely so, interspersed with scattered long hairs, drying thin, brown, translucent; petiole scarcely 1 cm. long, densely villous with mixed long hairs, vaginate below the middle; spikes 5 mm. thick \times 5-6 cm. long when mature, with a slender, seta-like apex up to 7 mm. long; peduncle 4-6 cm. long, villous with an intermixture of long hairs; bracts triangular-subpeltate, marginally fringed with rigid hairs, those on the dorsal margin somewhat longer; drupe compressed-oblong, glabrous, glandular, stigmas slender, sessile.

Known only from the type locality.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *von Wedel 1015*; Water Valley, *von Wedel 1446*—this specimen is not as densely pubescent as the others; Nov. 9, 1940, *von Wedel 1569* (Herb. Missouri Bot. Gard., TYPE).

The wide difference in the length of the hairs, rather large, subauriculate leaves, setose spikes, and long slender peduncles are distinctive characters of this species.

72. *PIPER PSEUDO-GARAGARANUM* Trel. in Contr. U. S. Nat. Herb. 26:28. 1927.

Shrub, 1-2 m. tall, nodose; flowering internodes short and slender, moderately to sparsely villous, glabrescent downward, hairs up to 1 mm. or more long, somewhat granular and glandular-dotted; leaves elliptic or elliptic-lanceolate, apex rather long-acuminate, base rounded, inequilateral, one side 2-4 mm. shorter, obtuse, the longer side cordulate, pinnately nerved from the lower half, the nerves mostly alternate, 4 or in larger leaves 5 on each side, with slender cross-connecting and anastomosing nervules, 4.5-7.5 cm. wide \times 14-20 cm. long, smooth or very slightly scabrous, sparsely long-villous above, loosely long-villous beneath, at least along the nerves, the hairs mostly erect, drying papery, glandular-dotted, translucent; petiole 2-4 plus 2 mm. long, villous, vaginate at the base; spikes 3 mm. thick \times 7.5 cm. long; peduncle scarcely 1 cm. long, granular, glabrous; bracts round-subpeltate, moderately fringed, a few dorsal hairs longer; fruit obpyramidal-trigonous, glandular-dotted, apex truncate, glabrous, stigmas sessile.

Panama.

CANAL ZONE: Barro Colorado Island, Standley 31400, 41164. DARIÉN: Caña-Cuasi Trail (Camp 2), Chepigana Distr., alt. 600 m., Terry & Terry 1427.

The specimens cited differ considerably in the size of the leaves. Those on No. 41164 are scarcely 5 cm. wide \times 14–15 cm. long while those on No. 1427 are 7–8 cm. wide \times 18–20 cm. long. No. 31409 is intermediate in size. The description of the spike characters are from *Terry & Terry 1427*. The spikes on the other two specimens are very young and do not exhibit ovary or fruit characters. All specimens agree otherwise.

73. *PIPER CATIVALENSE* Trel. in *Contr. U. S. Nat. Herb.* 26:34. 1927.

Shrub, 2–3 m. tall; flowering internodes slender, rather elongate, villous; leaves elliptic to subobovate, apex rather abruptly acuminate, base inequilateral, cordulate, one side slightly shorter, 6–7 cm. wide \times 12–14 cm. long, pinnately nerved from the lower half or two-thirds, the nerves mostly 5 on each side, with cross-connecting and anastomosing nervules, somewhat glossy green, very slightly scabrous and sparsely villous above, the nerves scarcely hairy, villous beneath, especially along the nerves, marginally somewhat ciliate, glandular-dotted on both sides, drying thin, translucent; petiole 5–10 plus 2 mm. long, villous, vaginate toward the base; inflorescence not known.

Known only from the following locality.

COLÓN: between France Field, Canal Zone, and Catival, *Standley 30206*.

The absence of inflorescence leaves the position of this species somewhat questionable.

74. *PIPER PSEUDO-LANCEAEFOLIUM* Trel. in *Contr. U. S. Nat. Herb.* 26:170. 1929.

Piper liratinerve Trel. in *Ann. Mo. Bot. Gard.* 24:186. 1937.

A shrub, 2 m. or more tall; upper internodes slender, sparsely to densely appressed-villous; leaves subinequilaterally lanceolate, apex gradually sharply long-acuminate, base inequilateral with one side about 2 mm. shorter, obtuse, cordulate, or sometimes acutish, mostly 4–5 cm. wide \times 14–17 cm. long, pinnately nerved from the lower half, the nerves mostly 7–8 on each side, impressed above, salient beneath, veiny, rugescent and subappressed-pubescent above, scarcely lacunose beneath, appressed-pubescent, the nerves densely so, obscurely pale glandular-dotted, drying firm, translucent; petiole about 5 plus 2 mm. long, vaginate-winged to near the blade, villous; spikes 2–3 mm. thick \times 8–12 cm. or more long, apiculate, curved; peduncle up to 2–3 cm. long, pubescent; bracts triangular-subpeltate, densely yellow-fringed; fruit obpyramidal-trigonous, dark, apex truncate, glabrous, stigmas slender, sessile.

Costa Rica and Panama.

PANAMÁ: without locality, *Née 359, 400*. CHIRIQUI: valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m., *Seibert 158*; vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m., *Woodson, Allen & Seibert 910*.

This species resembles *P. lanceaefolium* in most characters and may be too close to it, but it differs because of its less but more coarsely rugose leaves which are scarcely lacunose beneath, and with the base much less cordulate-auriculate.

75. *PIPER LINEARIFOLIUM* C.DC. in Linnaea 37:355. 1872.

Piper alveatum Trel. in Ann. Mo. Bot. Gard. 27:287. 1940.

Piper arctilimbum Trel. loc. cit. 288. 1940.

Piper arctilimbum var. *Allenii* Trel. loc. cit. 1940.

A low, bushy shrub, scarcely 2 m. tall; flowering internodes moderately slender and short, gray-pubescent; leaves lanceolate, apex gradually long- and sharp-acuminate, base inequilateral with one side 2-3 mm. shorter, obtuse, cordulate, or some leaves acute, mostly 2-3.5 cm. wide \times 10-17 cm. long, subrugescens in age, pinnately nerved from the lower third, the nerves 4-5 or occasionally 6 on each side, prominent beneath, somewhat impressed above, subequally spaced, subparallel and sharply ascending from the midrib, appressed-silky-pubescent on both sides, the nerves more densely so beneath, glandular-dotted, drying rather firm, translucent, pellucid-dotted; petiole 3-5 plus 2-3 mm. long, pubescent, vaginate to near the blade; spikes 2-3 mm. thick \times 5-9 cm. long, generally curved; peduncle 5-15 mm. long, pubescent; bracts triangular-subpeltate, densely yellow-fringed; fruit obpyramidal, 3- or 4-sided, glabrous; stigmas small, sessile.

Costa Rica and Panama.

BOCAS DEL TORO: vicinity of Nievecita, alt. 0-150 m., Woodson, Allen & Seibert 1837; Chiriquí Trail, von Wedel 2176. CHIRIQUÍ: vicinity of El Boquete, alt. 1000-1300 m., Maxon 5140; Killip 3638; Isla de Coiba, Mendez 122; rocky plains about 5 miles south of Boquete, alt. 900 m., Allen 4705. COCLÉ: El Valle, Miller 1813; vicinity of El Valle de Antón, alt. 600 m., Allen 2003; Penonomé and vicinity, alt. 15-300 m., Williams 54. COLÓN: along Río Fató, alt. 10-100 m., Pittier 3881.

The narrowly lanceolate, silky-pubescent leaves, with sharply ascending nerves, curved spikes, and yellow-fringed bracts distinguish this species.

76. *PIPER PANAMENSE* C.DC. in Jour. Bot. 4:216. 1866.

Piper citrifolium Lam. var. *panamense* C.DC. in Candollea 1:114. 1923.

A shrub; flowering branches short, nodose, rather slender, densely subretroserely crisp-pubescent laterally below the petioles, glabrescent downward, glandular-papillate; leaves elliptic-ovate, apex acute to short-acuminate, base with one side slightly shorter at the petiole, rounded, obtuse, or one or both sides acutish, pinnately nerved below the upper third, the nerves 4-5 on each side, with cross-connecting-anastomosing nervules, 5-7 cm. wide \times 10-15 cm. long, glabrous above, puberulent beneath, at least along the nerves, glandular-dotted, drying firm and somewhat glossy, translucent; petiole scarcely 1 cm. long, rather densely subretroserely pubescent, vaginate near the base; spikes 3 mm. thick \times 4-5 cm. long; peduncle about 5 mm. long, puberulent; bracts triangular-subpeltate, ciliate; fruit oblong, compressed, apex truncate, depressed about the stigmas, strongly papillate-puberulent; stigmas sessile.

Panama.

BOCAS DEL TORO: Laguna de Chiriquí and vicinity, Hart 124. CANAL ZONE: Chagres, Fendler 270.

The densely papillate fruit and comparatively short, stout spikes distinguish this species.

77. *PIPER CALLIBRACTEUM* C.DC. in Smiths. Misc. Coll. 71⁶:13. 1920.

Piper chamissonis (Miq.) Steud. var. *rubellibracteum* C.DC. loc. cit. 1920.

Piper subnudibracteum C.DC. loc. cit. 14. 1920.

Piper nitidifolium C.DC. loc. cit. 1920.

A shrub, 1.5-3 m. tall; flowering internodes rather slender and short, glabrate, pale-dotted; leaves elliptic-lanceolate or subovate, apex acuminate, base inequilateral with one side mostly slightly shorter, acute on both sides or one side obtusish, 5-8 cm. wide \times 13-22 cm. long, smooth or slightly rugose, pinnately nerved from the lower half, the nerves 4 or sometimes 5 on each side, with cross-connecting and anastomosing nervules, glabrous above, obscurely appressed-pubescent beneath, at least on the smaller nerves, drying green, slightly paler and pale-glandular-dotted beneath; petioles up to 3 cm. long, glabrous, vaginate toward the base; spikes 3 mm. thick \times 8-10 cm. long, short-mucronate; peduncles 1-1.5 cm. long, glabrous; bracts rather small, triangular-lunate-subpeltate, somewhat umboinate, sparsely short-fringed; fruit compressed, white-papillate-puberulent at the top, stigmas sessile.

Western Panama.

CHIRIQUI: forests around El Boquete, alt. 1000-1300 m., Pittier 2940; Maxon 4943; Pittier 2898, 2899; between Cerro Vaca and Hato del Loro, alt. 850-1100 m., Pittier 5390.

The petioles of the type of *P. subnudibracteum* are scarcely 1 cm. long and the leaves are slightly more pubescent along the nerves beneath than are the types of the other species included here. All agree, however, in the pubescent ovary and fruit, small, scarcely fringed bracts, and other characters to such a degree that it is believed they all represent a single species which usually has petioles 1-3 cm. long, and nerves scarcely pubescent beneath.

78. *PIPER Wedelii* Yuncker, sp. nov.

Frutex, 1-2 m. altus; internodiis floriferis gracilibus brevibusque, delicate costulatis, dissite hirtulis; foliis subrhombico-ellipticis, apice longius acute acuminate, basi oblique, latere altero obtuso, ad petiolum 3 mm. breviore, caetero rotundato cordulato, a medio deorsum pinnatim venosis, venis utrinque 5-6, supra glabratibus vel dissite scabridis, subtus ad venas sat dissite substrigosis; petiolo ca. 5 cum 3 mm. longo, ad basem vaginato; spicis immaturis, 2 mm. crassis, 6 cm. longis, mucronatis; bracteis triangulari-subpeltatis, glabratibus, dorso papilloso-callosis; drupa ignota.

A tree-like shrub, 1-2 m. tall; flowering internodes short and slender, finely ridged when dry, granular-roughened, young growth obscurely hirtellous; leaves

subrhomboidal-elliptic, apex sharply long-acuminate, base oblique, one side 3 mm. shorter at the petiole and obtuse, the longer side rounded, cordulate, 9–10 cm. wide \times 20–22 cm. long, pinnately nerved from the lower half, the nerves 5–6 on each side with slender cross-connecting-anastomosing nervules, glabrous or slightly scabrous above, the nerves beneath rather sparsely substrigose, glandular-dotted on both sides, drying thin, translucent; petiole about 5 plus 3 mm. long, vaginate at the base; spikes as yet young, red when fresh, 2 mm. thick \times 6 cm. long, mucronate; bracts triangular-subpeltate, glabrous, with a dorsal papillate callus; ovary and fruit not present.

Known only from the type locality.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Oct. 2, 1940, von Wedel 1021 (Herb. Missouri Bot. Gard., TYPE).

78a. *PIPER WEDELI* var. *retrohirsutum* Yuncker, var. nov.

Internodiis floriferis retrorse hirsutis; foliis ellipticis, 4–5 cm. latis, 11–13 cm. longis, supra scabridis obscure hispidulisque, subtus ad venas strigosis, glandulosopunctatis.

Flowering internodes retrorse hirsute; leaves elliptic, 4–5 cm. wide \times 11–13 cm. long, obscurely hispidulous and scabrous above, the nerves beneath strigose, glandular-dotted.

Known only from the type locality.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Water Valley, Nov. 9, 1940, von Wedel 1575 (Herb. Missouri Bot. Gard., TYPE).

This species resembles *P. erubescenspicum* in the appearance of the spikes but it differs because of its larger, non-villous, conspicuously glandular, and scarcely scabrous leaves. The dorsally calloused floral bracts are rather distinctive. The smaller leaves and strongly retrorse hirsute twigs contrast the variety.

79. *PIPER VERRUCULAEPIETIOLUM* Trel. in Field Mus. Publ. Bot. 18:368. 1937.

Shrub, nodose; flowering internodes comparatively short and slender, glabrous, pale granular-dotted; leaves obliquely ovate-elliptic, apex short-acuminate, base obliquely inequilateral, one side 2–3 mm. shorter, the longer side strongly cordulate, 7–10 cm. wide \times 17–24 cm. long, pinnately nerved below the upper third, the nerves 6–8 on each side, with cross-connecting and anastomosing nervules, glabrous above, very finely puberulent on the nerves beneath, yellow glandular-dotted on both sides, drying thin, translucent; petiole 7 plus 2–3 mm. long, strongly granular, glabrous or sparingly puberulent, vaginate at the base; spikes 3 mm. thick \times 7–8 cm. long; peduncle about 5 mm. long, glabrous, granular; bracts triangular-subpeltate, marginally yellow-fringed; fruit trigonous, glabrous, glandular-dotted, truncate; stigmas sessile.

Known only from the following locality.

BOCAS DEL TORO: Farm Six, Changuinola Valley, Dunlap 494.

80. *PIPER HIRTELLIPETIOLUM* C.DC. in Smiths. Misc. Coll. 71⁶:3. 1920.

A conical, tree-like shrub, 1.5–2 m. tall, nodose; flowering internodes very short and slender, glandular-dotted, glabrous or at first with a few scattered hairs; leaves lanceolate, apex gradually acuminate, base subinequilateral, one side 1–2 mm. shorter, acute or obtusish, 2.5–3.5 cm. wide \times 9–13 cm. long, pinnately nerved from below the middle, the nerves 3–4 on each side, loop-connected upward, with cross-connecting and anastomosing nervules, glabrous on both sides or the midrib sparsely hairy near the base, drying light green, glossy above, pale glandular-dotted beneath; petiole scarcely 5 plus 2 mm. long, loosely villous, vaginate at the base; spikes 3 mm. thick \times 4–5 cm. long; peduncle 5 mm. long, puberulent above the middle; bracts triangular-subpeltate, copiously yellow-fringed, usually annular, alternating with the dark fruits; fruit rounded-ovoid (?), glabrous, black; stigmas small, sessile.

Known only from David, Chiriquí.

CHIRIQUÍ: vicinity of David, alt. 30–80 m., Pittier 2832.

80a. *PIPER HIRTELLIPETIOLUM* var. *tapiatum* (Trel.) Yuncker, comb. nov.

Piper tapiatum Trel. in Contr. U. S. Nat. Herb. 26:30. 1927.

Shrub, 3 m. tall; twigs moderately to rather densely crisp-villous; leaves 3.5–6.5 cm. wide \times 10–16 cm. long, glabrous and glossy above, strongly glandular-dotted beneath with the nerves crisp-pubescent; petioles crisp-hairy; spikes 5–6 cm. long.

Central Panama.

PANAMÁ: near Tapia River, Juan Díaz region, June 1–3, 1923, Maxon & Harvey 6709 (U. S. Nat. Herb., TYPE); Rio Tapia, Standley 26122; Perlas Archipelago, San José Island, Johnston 1360; Erlanson 176.

80b. *PIPER HIRTELLIPETIOLUM* var.

Harveyanum (Trel.) Yuncker, comb. nov.

Piper subtrinerve var. *Harveyanum* Trel. loc. cit. 30. 1927.

Piper subtrinerve Trel. in Contr. U. S. Nat. Herb. 26:29. 1927.

Piper perfugii Trel. in Ann. Mo. Bot. Gard. 27:295. 1940.

An essentially glabrous, somewhat nodose shrub, 1.5–3 m. tall; leaves lance-elliptic, 2–4.5 cm. wide \times 7–15 cm. long, glabrous or rarely with a few scattered short hairs on the nerves beneath; petiole glabrous; spikes 3–4 mm. thick \times 4–6 cm. long; peduncle with a few short hairs near the spike.



Fig. 11. *Piper hirtellipetiolum* var. *Harveyanum*

Panama.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 231—the spikes of this specimen are apiculate. CHIRIQUÍ: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m., *Woodson, Allen & Seibert* 928—this specimen has leaves somewhat smaller than usual. COCLÉ: El Valle, *Miller* 1814. CANAL ZONE: Las Sabanas, *Bro. Celestine* 110; foot of Corozal Hill, *Miller* 1790. PANAMÁ: near Tapia River, Juan Diaz region, *Maxon & Harvey* 6684, 6734; Juan Diaz, *Standley* 30600; along the Corozal Road, near Panamá, *Standley* 26854; Tumba Muerto Road, near Panamá, *Standley* 29710; Punta Paitilla, *Piper* 5410; east of Río Tecumén, *Standley* 26563; between Las Sabanas and Matías Hernández, *Standley* 31836; Taboga Island, *Standley* 27869; *Pittier* 3618 (U. S. Nat. Herb., TYPE); Perlas Archipelago, San José Island, *Johnston* 81, 754.

The specimens included under this species, including the varieties, all agree to such a degree that it does not appear advisable to maintain the varieties as separate species. The chief distinction appears to be in the character and amount of pubescence.

81. *PIPER SUBCAUDATUM* Trel. in Contr. U. S. Nat. Herb. 26:31. 1927.

Shrub (?), nodose; flowering internodes slender and short, somewhat ridged and striate-pilose, especially below the petioles; leaves obliquely elliptic or elliptic-obovate, apex abruptly subcaudately long-acuminate, tip about 2.5 cm. long, base narrowed downward, obtuse or subcordulate, one side about 3 mm. shorter, 6–8 cm. wide \times 13–16 cm. long, pinnately nerved below the upper third, the nerves 5 or 6 on each side, with cross-connecting-anastomosing nervules, submarginally loop-connected upward and, excepting the innermost pair, not continuing to the apex, glabrous above, the nerves beneath appressed-puberulent, both sides glandular-dotted, drying somewhat glossy, thin, translucent; petiole about 5 plus 3 mm. long, hairy-lined beneath, vaginate near the base; spikes as yet very young, 1 mm. thick \times 1 cm. long; peduncle sparsely hairy; bracts rounded-subpeltate, marginally ciliate; ovary and fruit not developed.

Known only from Sambú basin, Darién.

DARIÉN: foothills of Garagará, Sambú basin, alt. 30–500 m., *Pittier* 5612.

81a. *PIPER SUBCAUDATUM* var. *maternale* (Trel.) Yuncker, comb. nov.

Piper maternale Trel. in Field Mus. Publ. Bot. 18:349. 1937.

Leaves somewhat oblique, elliptic or elliptic-subovate, apex tip about 1 cm. long, base more strongly cordulate.

Panama.

BOCAS DEL TORO: vicinity of Almirante, *Cooper* 189, 210 (Herb. New York Bot. Gard. and Herb. Univ. Ill., ISOTYPES); Changuinola Valley, Bar Mouth, *Dunlap* 536; Old Bank Island, *von Wedel* 2047.

The shape and venation of the mostly cordulate-based leaves characterize this species. It is to be distinguished from *P. culebranum* chiefly because the lateral

nerves do not continue toward the apex as in that species. There is some question whether var. *maternale* differs sufficiently from the species to merit recognition. The leaf shape and shorter apex are the main differential features.

82. *PIPER GONOCARPUM* Trel. in Contr. U. S. Nat. Herb. 26:28. 1927.

A shrub, 2 m. tall; flowering internodes moderately slender and elongate, densely retrorsely dingy-pubescent; leaves lance-elliptic or suboblong, apex gradually acuminate, base somewhat inequilateral, rounded or cordulate, one side slightly shorter, 5-6.5 cm. wide \times 15-17 cm. long, pinnately nerved from below the upper third, the nerves about 6 on each side, glabrous above, the midrib impressed below the middle, hirsute beneath, the nerves rather densely so, the hairs staring, drying rather thick, subtranslucent, glossy above, narrowly revolute; petiole about 10 plus 2 mm. long, densely pubescent, vaginate to the blade; spikes 7-8 mm. thick \times 4 cm. long, caudate at the tip; peduncle scarcely 1 cm. long, sparsely hairy; bracts broad, narrowly lunate-concave, glabrous; fruit depressed-quadrangular, 2-3 mm. in diameter, ridged, granular, glabrous; stigmas 2, broad, sessile.

Canal Zone.

CANAL ZONE: hills north of Frijoles, Standley 27437.

The short, thick spikes, and large, angular fruits are distinctive of this species.

V. KEY TO SPECIES WITH LEAVES PINNATELY NERVED TO THE UPPER FOURTH OR THROUGHOUT.

- a. Midrib branches 10-15 on each side, subequally spaced; leaves mostly 10 cm. or more wide; spikes mostly 8-10 mm. thick..... 83. *P. AUGUSTUM*
- aa. Midrib branches usually less than 10 and commonly variously spaced; leaves mostly narrower.
 - b. Leaf base strongly inequilateral with one side mostly 5-10 mm. shorter at the petiole.
 - c. Leaves somewhat scabrid; stems villous; petiole vaginate to the middle..... 84. *P. STEVENSI*
 - cc. Leaves not scabrid; stems glabrous or puberulent; petiole vaginate-winged to the blade, the wings often protracted at the blade.
 - d. Leaves 25 cm. or more long; nerves 6-7 on each side..... 85. *P. COLONENSE*
 - dd. Leaves mostly less than 20 cm. long; nerves 8-10 on each side.
 - e. Leaf apex very short and abruptly acute; leaves mostly less than 12 cm. long..... 86. *P. TUBERCULATUM*
 - ee. Leaf apex gradually acute to acuminate; leaves commonly 15 cm. or more long (shorter in var.)..... 87. *P. ARBOREUM*
 - bb. Leaf base mostly essentially equilateral or sometimes oblique or with one side slightly shorter.
 - c. Leaves mostly 7-9 cm. long; spikes scant 2 cm. long..... 88. *P. SUBREPENS*
 - cc. Leaves mostly 10-15 cm. or more long; spikes longer (short in *P. candelariatum*).
 - d. Petiole strongly vaginate-winged to the blade; leaves bronzed beneath, nerves prominently submarginally loop-connected; peduncle scarcely 5 mm. long..... 89. *P. CORDULATUM*
 - dd. Petiole usually not vaginate-winged to the blade though sometimes grooved above; leaves green or brown but not bronzed.
 - e. Bracts cupulate, glabrous; fruit free on the rachis, exserted, very short styloose..... 3. *P. DARIENENSE*
 - ee. Bracts more or less peltate; fruit congested on the rachis.

- f. Leaves mostly less than 5 cm. wide.
- g. Leaves obviously glandular-dotted beneath.
 - h. Spikes 5 cm. or more long; stigmas sessile..... 90. *P. ACUTISSIMUM*
 - hh. Spikes less than 3 cm. long; fruit short-stylose 12. *P. CANDELARIANUM*
- gg. Leaves not obviously glandular-dotted.
 - h. Stems glabrous..... 91. *P. PERLASENSE*
 - hh. Stems densely hairy..... 92. *P. VIA-CHICOENSE*
- ff. Leaves 6 cm. or more wide..... 93. *P. GRANDE*

83. *PIPER AUGUSTUM* Rudge, Pl. Guian, Rar. 1:10, pl. 7. 1805.

Piper angustum Rudge ex Spreng. Syst. Veg. 1:108. 1825, sphalm.

Artanthe angusta Miq. Syst. Pip. 398. 1844.

Artanthe calocoma Miq. in Seem. Bot. Voy. Herald, 199. 1854.

Piper pedicellare C.D.C. in Jour. Bot. 4:211. 1866.

Piper calocoma C.D.C. in DC. Prodr. 16¹:264. 1869.

A glabrous shrub, 2-3 m. tall, or small tree up to 8 m., branches somewhat nodose, with moderate internodes; leaves elliptic-ovate, 9-15 or 18 cm. wide \times 15-35 cm. long, apex acute, base acute or obtusish, usually subequilateral, pinnately nerved throughout, the nerves 10-16 on each side, not strongly curved upward, densely ciliate, strongly glandular-dotted, drying membranous, translucent; petiole 5-10 mm. long or up to 4 cm. on lower leaves; spikes when young 3 mm. thick \times 4-5 cm. long, becoming 1-1.5 cm. \times 8-12 cm. when mature; peduncle 1-2 or 3 cm. long; bracts sublunate-triangular-subpeltate, marginally yellow-fringed; fruit oblong, compressed-angular, truncate; stigmas sessile.

Northern South America and Panama.

COCLÉ: Bismarck, above Penonomé, alt. 600-900 m., Williams 332, 611. CANAL ZONE: in forest along the Río Indio de Gatún, Pittier 2790, 2791.

83a. *PIPER AUGUSTUM* var. *cocleanum* (Trel.)

Yuncker, comb. nov.

Piper polyneurus C.D.C. in Candollea 1:270. 1923, name only in index; Schroeder, loc. cit. 3:138. 1926.

Piper gatunense Trel. in Contr. U. S. Nat. Herb. 26:27. 1927.

Piper ladrillense Trel. loc. cit. 1927.

Piper gatunense var. *cocleanum* Trel. in Ann. Mo. Bot. Gard. 27:292. 1940.

Piper gatunense var. *latum* Trel. loc. cit. 1940.

Upper internodes sparsely to rather strongly puberulent or pubescent; leaves above from glabrous to rather strongly white-villous, puberulent to villous beneath, at least along the nerves.

Panama.

CHIRIQUI: forests along the Río Ladrillo and vicinity, above El Boquete, alt. 1200-1300 m., Pittier 3164. COCLÉ: north rim, vicinity of El Valle de Antón, alt. 600-1000 m., Allen 1784, 1808. CANAL ZONE: Gatún, Hayes 502; hills north of Frijoles, Standley 27465, 27491, 27495.

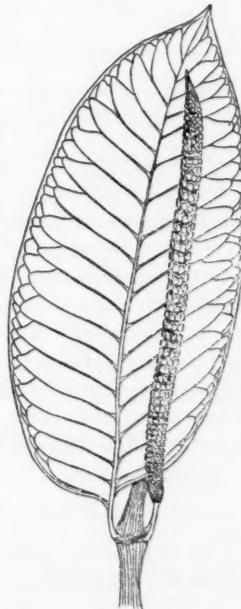


Fig. 12. *Piper augustum* var. *cocleanum*

DARIÉN: Cerro de Garagará, Sambú Basin, alt. 500-974 m., Pittier 5977 (U. S. Nat. Herb., TYPE).

This species is to be identified because of its large, strongly pinnately nerved, densely ciliate, glandular-dotted leaves, and thick spikes. The original *P. augustum* of Rudge, so far as can be determined, was entirely glabrous. Variety *cocleanum* has pubescent stems and more strongly pubescent leaves. Standley's Nos. 27465 and 27491 are conspicuously white-villous. No other differences have been noted, however.

84. *PIPER STEVENSI* Trél. in Contr. U. S. Nat. Herb. 26:27. 1927.

A shrub (?); flowering internodes comparatively long and stout, rather densely subretroserely crisp-villous; leaves elliptic, apex abruptly short-acuminate, base inequilateral, one side 5-10 mm. shorter and acute, the longer side rounded to the petiole, 10-12 cm. wide \times 20-23 cm. long, pinnately nerved to the upper fourth or nearly throughout, with intermediate cross-connecting nervules, the nerves 7-8 on each side, finely scabrous, sparsely to moderately crisp-pubescent on both sides, the nerves densely hirsute, sparingly glandular-dotted beneath, drying papery, translucent, finely pellucid-dotted; petiole 20 plus 5-10 mm. long, vaginate to the middle or above, densely crisp-hairy; spikes 5 mm. thick \times 7-8 cm. long; peduncle 1.5-2 cm. long, densely subretroserely crisp-hairy; bracts triangular-subpeltate, densely ciliate; fruit oblong, glabrous, stigmas sessile.

Known only from Frijoles, Canal Zone.

CANAL ZONE: Frijoles, Stevens 1247.

The rather large, somewhat scabrous, pinnately nerved leaves, dense pubescence, and comparatively thick spikes characterize this species.

85. *PIPER COLONENSE* C.D.C. in Smiths. Misc. Coll. 71⁶:11. 1920.

Shrub, 2-5 m. tall, nodose; flowering internodes rather short and thick, puberulent; leaves oblong-elliptic, apex rather abruptly acuminate, base rounded, obtuse or cordulate, one side about 5 mm. shorter, 10-11.5 cm. wide \times 25-31 cm. long, pinnately nerved from below the upper fourth, the nerves 6 or 7 on each side, with intermediates and cross-connecting and anastomosing nervules, the nerves on both sides puberulent but more conspicuously so above, drying green, paler and pale glandular-dotted beneath, translucent; petiole stout, 10-15 plus 5 mm. long, puberulent, vaginate to near the blade; spikes 3 mm. thick \times 10 cm. long; peduncle 15 mm. long, rather stout, puberulent; bracts rounded-triangular-subpeltate, conspicuously yellow-fringed; ovary glabrous; stigmas filiform, sessile.

Central Panama.

COLÓN: around Dos Bocas, Rio Fató valley, alt. 40-80 m., Pittier 4221.

The large leaves, puberulent on both sides, puberulent twigs, and vaginate petioles distinguish this species.

86. PIPER TUBERCULATUM Jacq. Collect. 2:2, pl. 211. 1788.

Piper macrourum H.B.K. Nov. Gen. & Sp. 1:54. 1815.
Piper nutans Opiz in Presl, Reliq. Haenk. 1:156, pl. 28, f. 2. 1830.
Steffensia tuberculata Kunth, in Linnaea 13:614. 1839.
Piper scabrum Willd. in hb. p.p., fide Kunth, loc. cit. 1839.
Piper obliquum Balbis in hb., fide Kunth, loc. cit. 1839.
Artanthe decurrens Miq. Syst. Pip. 402. 1844.
Artanthe tuberculata Miq. loc. cit. 497. 1844.
Piper tuberculatum var. *rigido-membranaceum* C.D.C. in DC. Prodr. 16¹:266. 1869.

A very nodose shrub or small tree, 2-4 or sometimes up to 6 or 7 m. tall; branches often warty, puberulent when young or less commonly glabrous; leaves subelliptic, subovate, or mostly elliptic-oblong, 3-6 or occasionally up to 10 cm. wide \times 7-14 cm. long, apex shortly and rather abruptly acute, base rounded, one side 5-10 mm. shorter at the petiole, the shorter side more elliptic and slightly wider than the longer side, pinnately nerved to near the apex, the nerves 8-10 on each side, with intermediates, rather prominent beneath, glabrous or sparsely puberulent above, puberulent beneath, at least along the nerves, or rarely glabrate, drying membranous, somewhat translucent, obscurely minutely pellucid-dotted; petiole about 5-10 plus 5-10 mm. long, vaginate and narrowly winged throughout with the wings acutely protracted at the base of the blade; spikes 3-5 mm. thick \times 5-10 or 12 cm. long; peduncle mostly 10-15 mm. long, rarely up to 2 or 3 cm.; bracts triangular-subpeltate, marginally fringed; fruit somewhat tetragonal, glabrous; stigmas 3, sessile.

West Indies, Central America, and throughout northern South America.

PANAMÁ: without location, Hayes 802; Bro. Heriberto 267. CANAL ZONE: Balboa, Standley 25409; near Bojí Station, Panama R. R., Hayes 1017; Empire, Stevens 1143; Miller 1863; near Gorgas Memorial Laboratory, White 84; western slope of Ancón Hill, vicinity of Balboa, alt. 20-75 m., Seibert 119; Las Cruces Trail, government forest, alt. 75 m., Hunter & Dodge 759. PANAMÁ: along the Río Chilibre, Piper 5681; vicinity of Bella Vista, Piper 5375; along Río Juan Diaz, above Juan Diaz, alt. 30 m., Allen 943; Taboga Island, Miller 2041; alt. 0-350 m., Allen 1287; alt. 0-186 m., Woodson, Allen & Seibert 1508; Perlas Archipelago, Saboga Island, Miller 1950.

86a. PIPER TUBERCULATUM var. MINUS C.D.C. in DC. Prodr. 16¹:266. 1869.

Leaves smaller, mostly 3-7 or sometimes 8 cm. long.

Occurs with the species.

COCLÉ: Penonomé and vicinity, alt. 15-300 m., Williams 73, 1155. CANAL ZONE: near Gorgas Memorial Laboratory, White 84; Empire, Miller 1863; Sabanas north of Panama City, Bro. Paul 371.

87. PIPER ARBOREUM Aubl. Hist. Pl. Guian. Fr. 1:23. 1775.

Piper macrophyllum Sw. Prodr. Veg. Ind. Occ. 15. 1788.
Piper geniculatum loc. cit. 1788.
Piper verrucosum loc. cit. 1788.
Piper nitidum loc. cit. 1788.
Piper nodulosum Link in Jahrb. d. Gewächsk. 1³:62. 1820, name only; Link, Enum. Hort. Berol. 1:36. 1821.
Steffensia xylopioides Kunth, in Linnaea 13:610. 1839.

Piper xylopioides Kunth, loc. cit. 1839.
Steffensia? nitida Kunth, loc. cit. 611. 1839.
Steffensia geniculata Kunth, loc. cit. 612. 1839.
Piper secundum Poepp. in hb. fide Kunth, loc. cit. 1839.
Steffensia? verrucosa Kunth, loc. cit. 613. 1839.
Steffensia Luschnathiana Kunth, loc. cit. 616. 1839.
Piper Luschnathianum Kunth, loc. cit. 617. 1839.
Artantbe Lessertiana Miq. Syst. Pip. 405. 1844.
Artantbe xestophylla Miq. loc. cit. 491. 1844.
Artantbe xylopioides Miq. loc. cit. 492. 1844.
Artantbe geniculata Miq. loc. cit. 493. 1844.
Artantbe Luschnathiana Miq. loc. cit. 494. 1844.
Artantbe verrucosa Griseb. Fl. Br. W. Ind. 171. 1864.
Artantbe macrophylla Griseb. loc. cit. 1864.
Piper arboreum f. *geniculata* Fawc. & Rend., Fl. Jam. 3:23. 1914.
Piper laevibracteum Trel. in Contr. U. S. Nat. Herb. 26:26. 1927.
Piper subnudispicum Trel. loc. cit. 1927.
Piper tuberculatum var. *Allenii* Trel. in Ann. Mo. Bot. Gard. 27:298. 1940.

A glabrous, somewhat nodose shrub, or small tree, mostly 2-7 m. tall; flowering internodes rather short but slender, more or less verrucose-warty; leaves elliptic-ovate, oblong, or lance-elliptic, mostly 6-11 cm. wide \times 10-25 cm. long, apex gradually acute to short-acuminate, rounded at base, or narrow leaves acute, one side 5-10 mm. shorter at the petiole, or occasional leaves equilateral, pinnately nerved throughout, the nerves 8-10 on each side with some intermediates; petiole 5-10 plus 5-10 mm. long, vaginate-winged to the blade with the wings protracted beyond the lower blade margin; spikes rather slender and elongated, 2-4 mm. thick and up to 15 cm. long but mostly 5-10 cm.; peduncle 5-10 mm. long and moderately stout; bracts triangular-subpeltate, marginally ciliolate; fruit elongated with the rachis, glabrous; stigmas 3, sessile.

West Indies, northern South America, and Panama.

CHIRIQUÍ: Cerro Vaca, alt. 900-1136 m., Pittier 5324. COCLÉ: north rim of El Valle de Antón, alt. 600-1000 m., Allen 1640. CANAL ZONE: Barro Colorado Island, Gatún Lake, Standley 41089; Maxon, Harvey & Valentine 6813; vicinity of Fort Sherman, Standley 31115. COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), a't. 10-104 m., Pittier 4241.

87a. *PIPER ARBOREUM* var. *hirtellum* Yuncker, var. nov.

A speciei forma typica differt innovationibus, petiolis, pedunculis, venis subtus plus minusve puberulentis.

Similar to the species except that the young branches, petioles, peduncles, and nerves, especially on the lower surface, are more or less minutely puberulent or hirtellous with erect hairs.—BRITISH GUIANA: NORTHWEST DISTRICT: Waini River, April 3-18, 1923, de la Cruz 3623 (U. S. Nat. Herb., TYPE).

Northern South America and Panama.

CHIRIQUÍ: vicinity of San Felix, alt. 0-120 m., Pittier 5131. CANAL ZONE: hills north of Frijoles, Standley 27519. PANAMÁ: Perlas Archipelago, San José Island, Johnston 424, 594.

87b. *PIPER ARBOREUM* var. *falcifolium* (Trel.) Yuncker, comb. nov.*Piper falcifolium* Trel. in Contr. U. S. Nat. Herb. 26:25. 1927.

Leaves oblong-lanceolate, 3–5 cm. wide \times 10–20 cm. long, apex acuminate, base inequilateral, rounded, obtuse or acute.

West Indies, northern South America, and Panama.

CHIRIQUÍ: Boquete District, alt. 1140 m., *Davidson* 618; vicinity of El Boquete, alt. 1000–1300 m., *Maxon* 4959, 5381; *Pittier* 2958; *Bro. Maurice* 738; vicinity of San Felix, alt. 0–120 m., Dec. 1911, *Pittier* 5137; Sabana de la Tortuga, between El Boquete and Caldera, alt. 300–700 m., *Pittier* 3327. PANAMÁ: Perlas Archipelago, San José Island, *Johnston* 656, 1373.

This species appears to be extremely variable in the size of the leaves and to some extent also the shape. Aside from these variations and the presence of short, stiff hairs in one variety, no characters have been discovered by means of which the specific distinctions suggested by the rather long list of synonyms may be maintained. They are believed to be merely varying members of a rather polymorphic species.

88. *PIPER SUBREPENS* Trel. in Ann. Mo. Bot. Gard. 24:187. 1937.

A nodose, glabrous shrub; flowering internodes short and moderately slender, drying yellowish-glossy; leaves lance-ovate, apex acuminate, base rounded, obtuse, equilateral, or one side very slightly shorter, 2–3.5 cm. wide \times 6.5–9 cm. long, pinnately nerved to the upper fourth or nearly throughout, the nerves 3–4 on each side, strongly curving toward the tip submarginally, with intermediates and cross-connecting and anastomosing nervules, the nerves beneath and the midrib above salient, drying firm, glossy, not glandular-dotted, subopaque, narrowly revolute, light green; petiole up to 1 cm. long, glossy, vaginate-winged to the middle or below; spikes 3 mm. thick \times 2 cm. long; peduncle slender, up to 1 cm. long; bracts triangular- or rounded-subpeltate, submarginally fringed; fruit obpyramidal-trigonous with dome-shaped apex, glabrous, stigmas filiform, sessile.

Known only from the following locality.

COCLÉ: very near the crest of Cerro Valle Chiquito, alt. 700–800 m., *Seibert* 504.

The short spikes and moderately small leaves with rounded, subequilateral bases distinguish this species.

89. *PIPER CORDULATUM* C.DC. in Jour. Bot. 4:217. 1866.

Artanthe trinervia Miq. in Seem. Bot. Voy. Herald, 200, pl. 41. 1854.

Piper trinerve C.DC. in DC. Prodr. 16:292. 1869, not Vahl, 1804.

?*Piper cordulatum* var. *granulatum* Trel. in Contr. U. S. Nat. Herb. 26:26. 1927.

Piper san-lorenzianum Trel. loc. cit. 29. 1927.

A glabrous shrub or small tree, 1–3 m. tall; flowering internodes rather slender and short, obscurely finely striate; leaves lanceolate or lance-oblance, apex sharp-acuminate, base rounded or commonly somewhat narrowed downward, one side

usually 1-2 mm. shorter, the longer side cordulate, 3-6 cm. wide \times 14-21 cm. long, pinnately nerved throughout, the nerves 7-12 on each side, strongly submarginally loop-connected, the longer nerves prolonged, salient, with cross-connecting and anastomosing nervules, drying rather coriaceous, narrowly revolute, somewhat glossy, usually bronzy-brown beneath, often with fine mottled markings, opaque; petiole 10-20 plus 1-2 mm. long, prominently vaginate-winged to the blade; spikes 3-4 mm. thick \times 5-7 cm. long, apiculate; peduncle about 5 mm. long; bracts concave or lunately subpeltate, papillate or glabrous; fruit depressed-ovoid, slightly elongated with the rachis, glabrous, glandular-dotted; stigmas 3, sessile.

Panama.

CANAL ZONE: Gatún Station, Hayes s. n., 66, 507, 739; between Gorgona and Gatún, alt. 10-50 m., Pittier 2267; Agua Clara Reservoir, Stevens 589; around Las Cruces, alt. 20-100 m., Pittier 2624; hills north of Frijoles, Standley 26450, 27578; Río Paraíso, above East Paraíso, Standley 29905; Barro Colorado Island, Wetmore & Abbe 23; Standley 31355, 40847; road to Madden Dam and Las Cruces Trail, alt. 75 m., Hunter & Allen 460. COLÓN: Chagres, Fendler 267. PANAMÁ: thickets and forests near Arraiján, alt. 15 m., Woodson, Allen & Seibert 782; Indio, Madden Lake, Miller 2050, 2065.

The somewhat bronze-colored leaves with cordulate base, loop-connected nerves, and strongly vaginate-winged petioles distinguish this species.

90. *PIPER ACUTISSIMUM* Trel. in Contr. U. S. Nat. Herb. 26:25. 1927.

Piper lucaeum Kunth var. *magnifolium* C.DC. in DC. Prodr. 16¹:322. 1869.
Piper seducentifolium Trel. in Ann. Mo. Bot. Gard. 27:297. 1940.

A shrub or small tree, 2-3 m. tall, more or less nodose, twigs straight or somewhat zig-zag, glabrous; flowering internodes short and rather slender; leaves lance-elliptic, 2.5-6 cm. wide \times 10-18 cm. long, apex acuminate, base subequilaterally acute, pinnately nerved throughout, the nerves 5-8 or 10 on each side, loop-connected upward, glabrous or rather sparsely pubescent along the nerves beneath, drying thin, translucent, glandular-dotted; petiole from 5 mm. long above to 10-15 mm. long below; spikes 3-4 mm. thick \times 5-9 cm. long; peduncle filiform, 1-2 cm. long; bracts triangular-subpeltate, sparsely marginally fringed; fruit trigonous, more or less granular-papillate, scarcely longer than thick, truncate-concave at apex; stigmas 3, short, sessile.

Panama and northern South America.

CANAL ZONE: hills north of Frijoles, Standley 27504, 27599. COLÓN: Chagres, Fendler 266. PANAMÁ: thickets and forests near Arraiján, alt. 15 m., Woodson, Allen & Seibert 781; Indio, Madden Lake, Miller 2060, 2079. DARIÉN: Dawe 887.

90a. *PIPER ACUTISSIMUM* var. *trichopus* (Trel.) Yuncker, comb. nov.

Piper trichopus Trel. in Contr. U. S. Nat. Herb. 26:25. 1927.

Young growth sparsely to densely pubescent; nerves beneath appressed-pubescent.

Panama.

PANAMA: without location, 1859-60, Hayes 797 (Herb. New York Bot. Gard., TYPE).

The glabrous twigs, and pinnately nerved, lanceolate, acuminate, and glandular-dotted leaves are distinctive features of this species. It differs from *P. lucaeum* of Brazil, according to Kunth's description of that species, because of its larger leaves, longer peduncles, and lack of styles. Variety *trichopus* appears to differ only in the pubescence.

91. *PIPER perlaseense* Yuncker, sp. nov.

Frutex glaber 2-3 m. altus, caulis nodosis; internodiis floriferis brevibus gracilibusque; foliis lanceolatis vel sat oblongo-lanceolatis, apice sensim subfalcatis longe acuminate, basi oblique subinequilateralibus latere altero 1-2 mm. breviore, latere longiore rotundo obtuso, totis vel e quarto supero tantum venosis, venis utrinque 6-8; petiolo deorsum vaginato; spicis 2-3 mm. crassis, 5-6 cm. longis; pedunculo ca. 5 mm. longo; bracteis triangularibus vel rotundato-peltatis margine fimbriatis; drupa parva glabrata obpyramidalis-trigona, stigmatibus parvis sessilibus.

A glabrous, nodose shrub 2-3 m. tall; flowering internodes short and slender; leaves lanceolate or somewhat oblong-lanceolate, apex rather gradually subfalcately long-acuminate, base obliquely slightly inequilateral with one side 1-2 mm. shorter and acute, the longer side rounded and obtuse, 2-4.5 cm. wide \times 9-15 cm. long, pinnately nerved to the upper one-fourth or throughout, the nerves 6-8 on each side, with intermediates, divergent at the midrib then strongly curved upward and submarginally loop-connected, drying papery, light green, somewhat glossy, translucent; petiole scarcely 5 plus 1-2 mm. or occasionally 1 cm. long, vaginate toward the base; spikes 2-3 mm. thick \times 5-6 cm. long when mature; peduncle about 5 mm. long; bracts triangular- or rounded-subpeltate, fringed; fruit small, obpyramidal-trigonal, glabrous, stigmas small, sessile.

Panama.

CANAL ZONE: Barro Colorado Island, Stevens 7. PANAMÁ: Perlas Archipelago, San José Island, Johnston 134, 262, 717; Jan. 22, 1946, Johnston 1215 (Herb. Univ. Ill., TYPE), 1327.

This species appears to be rather closely related to *P. aequale* of South America from which it differs, however, because of its mostly smaller, lanceolate leaves which are more definitely pinnately nerved, and rounded on one side at the base.

92. *PIPER via-chicoense* Yuncker, sp. nov.

Frutex (?); internodiis floriferis gracilibus brevibusque, conferte villosis, pilis usque ad 1 mm. longis plus minusve heteromorphis, brevioribus longioribusque intermixtis; foliis elliptico-vel lanceolato-oblongis, apice acuminate, basi obtusis vel pro more cordulatis, totis pinnatim venosis, venis utrinque 5 vel ultra, supra glabratris vel ad basem dissite pubescentibus, subtus crispe pubescentibus, venis conferte indutis, pilis dissitis longioribus; petiolo vix 5 mm. longo, conferte hirsuto, basi vaginato; spicis immaturis, 2 mm. crassis, 5 cm. longis, mucronatis; pedunculo 5 mm. longo, pubescente; bracteis triangulari-subpeltatis, margine fimbriatis; ovario ovoideo (?); stigmatibus sessilibus; drupa ignota.

Fig. 13. *Piper via-chicoense*

Shrub (?); flowering internodes short and slender, densely hairy, hairs of various lengths, the longest up to 1 mm. long; leaves elliptic- or lance-oblong, apex acuminate, base with one side slightly shorter at the petiole, both sides obtuse or mostly cordulate, 3-4.5 cm. wide \times 10-13 cm. long, pinnately nerved throughout, the nerves 5 or more on each side, more prominent downward, submarginally loop-connected, with cross-connecting-anastomosing nervules, glabrous above or sparsely pubescent at the very base, crisp-pubescent beneath, the nerves densely so and with interspersed long hairs, drying firm, subopaque; petiole scant 5 mm. long, densely hairy, vaginate at the base; spikes as yet young, 2 mm. thick \times 5 cm. long, mucronate; peduncle 5 mm. long, pubescent; bracts triangular-subpetiolate, marginally fringed; ovary ovoid (?); stigmas sessile; fruit not developed.

Known only from the type locality.

CANAL ZONE and adjacent PANAMÁ: forests along telephone cable trail between splice S16 and S49, Río Indio, Chico Trail, Jan. 12, 1935, Steyermark & Allen 17431 (Herb. Missouri Bot. Gard., TYPE).

93. *PIPER GRANDE* Vahl, Eclog. Amer. 2:3, pl. II. 1798.

Piper grandifolium H.B.K. Nov. Gen. & Sp. 1:46. 1815.

Piper riparium H.B.K. loc. cit. 48. 1815.

Schilleria riparia Kunth, in Linnaea 13:707. 1839.

Schilleria grandifolia Kunth, loc. cit. 709. 1839.

?*Piper granatense* D. Dietr. Syn. Pl. 1:117. 1839.

Artanthe grandifolia Miq. Syst. Pip. 408. 1844.

Artanthe riparia Miq. loc. cit. 409. 1844.

Piper pseudo-variabile Trel. in Contr. U. S. Nat. Herb. 26:23. 1927.

Piper pseudo-variabile var. *pachypus* Trel. loc. cit. 24. 1927.

Piper pseudo-variabile var. *collium* Trel. loc. cit. 1927.

Piper marmoreum Trel. in Ann. Mo. Bot. Gard. 24:186. 1937.

Piper spissinervium Trel. fide Bro. Tomás Alberto in Colegio San José, Medellin, Colombia.

Publ. 53-70, p. 18. 1942, name only.

A glabrous shrub or small tree, up to 5 m. tall; flowering internodes slender and moderately elongated; leaves ovate with the midrib commonly somewhat nearer one side, 8-23 cm. wide \times 16-30 cm. long, or some leaves may be slightly smaller, apex abruptly acuminate, base nearly equilaterally rounded, the upper acute or subacute, the larger lower leaves obtuse to subcordulate, or occasionally cordate, pinnately nerved to the upper one-third or essentially throughout, the nerves 6-8 or 10 on each side, with shorter intermediates, commonly yellow and prominent

beneath, the lowermost 2 or 3 pairs more or less approximated at the base, drying chartaceous, somewhat glossy, translucent; petiole 10–30 mm. long, the longer vaginate to or beyond the middle; spikes 4–5 mm. thick and up to 15 cm. long; peduncle rather stout, 5–10 mm. long; bracts rounded-subpeltate, umbonate, smooth above, villous beneath; fruit small, obpyramidal-trigonous, apex somewhat dome-shaped; stigmas 3, sessile.

Colombia and Panama.

CHIRIQUI: vicinity of San Felix, alt. 0–120 m., *Pittier 5189, 5262*. VERAGUAS: Isla de Coiba, *Mendez 121*. COCLÉ: vicinity of El Valle, alt. 600–1000 m., *Allen 1801*; vicinity of Ola, alt. 100–350 m., *Pittier 5075*; vicinity of El Valle de Antón, alt. 600 m., *Allen 2001*. CANAL ZONE: along Caño Quebrada, *Pittier 6662*; Barro Colorado Island, *Miller 2074*; *Kenoyer 306*; *Chrysler 4840*; *Chardon & Nolla 196*; *Standley 31308, 40875, 40930, 41054*—a narrow leaved form, *41076*; Río Paraíso, above East Paraiso, *Standley 29892*; Las Cascadas Plantation, near Summit, *Standley 25700, 29518, 29658*; hills west of the canal, near Gatún, *Standley 27191*; hills north of Frijoles, *Standley 27555*; between Frijoles and Monte Lirio, alt. 30 m., *Killip 12145*; Las Cascadas Plantation, near Summit, *Standley 25733*; Battery 46 Hill, Madden Dam road, *Miller 1772, 1773*; vicinity of Fort Sherman, *Standley 31022*; Obispo, *Standley 31702*; Ancón Hill, alt. 180 m., *Williams 19*; *Standley 25179*. COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), alt. 10–104 m., *Pittier 3845*; along trail to triangulation station on top of Tumba Vieja, alt. 90–200 m., *Dodge, Steyermark & Allen 16924*. PANAMÁ: Pacora River, *Killip 3141*; Río Tapia, *Standley 41188*; Indio, Madden Lake, *Miller 2061, 2062, 2063, 2066*; Río Tapia, *Standley 26130*—the leaves are somewhat smaller and this may represent a large-leaved form of *P. aequale*; Juan Díaz, *Standley 30610, 30577*; Perlas Archipelago, San José Island, *Erlanson 354*; vicinity of Arenosa, lower Río Trinidad, alt. 26–50 m., *Seibert 622*.

The large, ovate, glabrous leaves, drying somewhat glossy, with prominent yellow nerves, and smooth, umbonate floral bracts are distinctive features of this species.

The leaves show considerable variation in size often on the same specimen. The smaller-leaved specimens approach *P. aequale* with which this species is very closely related. These two species may, in fact, represent extremes in leaf size of a single strongly variable species.

VI. KEY TO SPECIES WITH PELTATE LEAVES

- a. Petiole 7 cm. or less long, vaginate to the middle or above; mostly with 3 nerves on each side of the midrib above the base.
- b. Leaves strongly bullate-rugose; young growth more or less rusty-tomentose..... 94. *P. HARTWEGIANUM*
- bb. Leaves not bullate-rugose, not hairy..... 95. *P. MAXONII*
- aa. Petiole 12 cm. long, vaginate at base only; with 2 nerves on each side of the midrib above the base..... 96. *P. VERAGUENSE*

94. *PIPER HARTWEGIANUM* (Benth.) C.DC. in DC. Prodr. 16¹:369. 1869.

Artanthe Hartwegiana Benth. Pl. Hartweg. 254. 1839.

Piper insignifolium C.DC. in Ann. Conserv. & Jard. Bot. Genève 21:242. 1920.

Piper Hayesii Trel. in Contr. U. S. Nat. Herb. 26:39. 1927.

A shrub or small tree, 3–5 m. tall, rusty-villous except for the upper leaf surface which is glabrescent or pubescent along the nerves only; twigs stout; leaves ovate or elliptic-ovate, 16–25 cm. wide \times 28–40 cm. long, apex acuminate, base inequilaterally rounded, obliquely retuse or shallowly cordate, peltate 3–6 cm.

from the margin, with 7–9 nerves radiating from the petiole, and the midrib with 3 or 4 branches on each side from the lower half, strongly rugose-bullate, drying firm and subopaque; petiole 5–7 cm. long, vaginate-winged to near the base of the blade; spikes up to 10 mm. thick and 35 cm. long when mature; peduncle 3–4 cm. long; bracts clavate, thickened and bristly at the top, pedicels bearded; fruit oblong-ovate, angular, glabrate; stigmas filiform, sessile.

Southwestern Colombia and Panama.

PANAMÁ: without locality, in 1859–60, Hayes 765.

No differences have been found between the above Panamanian specimen and those seen from South America which would justify maintaining *P. Hayesii* as a separate species.

95. *PIPER MAXONII* C.DC. in Smiths. Misc. Coll. 71⁶:16. 1920.

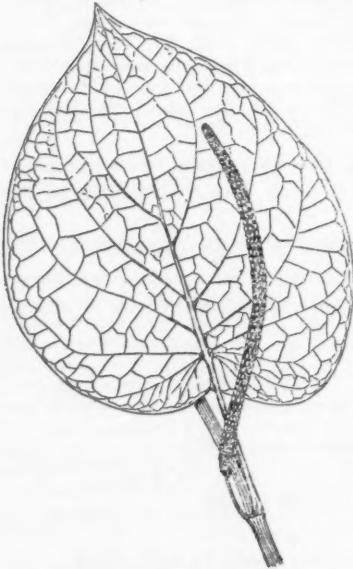
Piper Whiteae Trel. in Ann. Mo. Bot. Gard. 27:299. 1940.

A glabrous shrub or small tree, 3–6 m. tall; flowering internodes comparatively slender and rather short; leaves 5-sided, rounded-subovate, apex abruptly short-acuminate, base shallowly cordate with one side larger, peltate 1.5–3 cm. above the sinus, 11–18 cm. wide \times 16–26 cm. long, pinnately nerved from the lower half with 3 or 4 nerves approximated on each side near the petiole attachment and about 3 branches off each side of the midrib above, the nerves salient beneath with rather prominent cross-connecting and anastomosing nervules, drying rather firm, subtranslucent; petioles mostly 3–6 cm. long, vaginate-winged to near the blade; spikes up to 8 mm. thick \times 23 cm. long when mature; peduncles 1.5–2.5 cm. long; bracts rounded-triangular-subpeltate or subcucullate, ciliate; fruit depressed-ovoid, glabrous or sparsely hairy at the top; stigmas linear, subsessile, or on a short, stout style.

Panama.

Fig. 14. *Piper Maxonii* var. *varium*

CHIRIQUI: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m., Woodson, Allen & Seibert 977; valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m., Seibert 197; near El Volcán, White 177; vicinity of El Boquete, alt. 1000–1300 m., Maxon 5050; along Río Ladrillo, above El Boquete, alt. 1200–1300 m., Pittier 3163, 3164; Chiquero, Boquete District, alt. 1650 m., Davidson 509.



95a. *PIPER MAXONII* var. *varium* (Trel.) Yuncker, comb. nov.*Piper varium* Trel. in Ann. Mo. Bot. Gard. 27:299. 1940.

Petioles 4-6 cm. long, vaginate-winged to about the middle; bracts concave with subpeltate apex, glabrous-papillate, or occasionally with one or two short hairs.

Known only from the type locality.

CHIRIQUI: trail from Paso Ancho to Monte Lirio, upper valley of Rio Chiriquí Viejo, alt. 1500-2000 m., Allen 1401 (Herb. Univ. Ill., TYPE).

96. *PIPER VERAGUENSE* C.DC. in DC. Prodr. 16¹:294. 1869.

Shrub or small tree (?), glabrous; leaves ovate, apex sharply acuminate, peltate at one-sixth its length above the subcordately rounded base, 14 cm. wide \times 28 cm. long, with 10 nerves arising at the petiole and 2 branches ascending off the midrib on either side above; petiole 12 cm. long, vaginate at the base; spikes 3 mm. thick, much shorter than the blade; peduncle 15 mm. long; bracts angularly subpeltate; ovary and fruit not known.

Known only from the one collection.

PANAMA: locality inexact, "Veragua [and Costa Rica?]," Warscewicz s. n.

The type of this species has not been examined, and the above description is adapted from the original description and notes made from the type in the Boissier Herbarium by the late Professor Trelease. The peltate leaves with only two pair of lateral nerves above the base, and long petiole vaginate at the base appear to distinguish it sufficiently.

2. *OTTONIA* Sprengel*OTTONIA* Spreng. Neue Entdeck. 1:255. 1820.*Arctottonia* Trel. in Proc. Amer. Phil. Soc. 69:315. 1930.

Shrubs; leaves alternate; inflorescence racemose, leaf-opposed as in *Piper*; flowers pedicellate, scarcely crowded; stamens 4-6; ovary more or less 3-angled; stigmas 3; fruit a small, somewhat flask-shaped drupe.

There is some question as to whether the Pipers with racemose rather than spicate inflorescences constitute a genus distinct from *Piper*. So far as known at the present time, the North American species with racemose inflorescences all have palmate nervation and with stamens more or less adhering to the ovary, in contrast to the South American species characterized with pinnately nerved leaves. It is not believed that the differences upon which Trelease based the genus *Arctottonia* are of generic status.

1. *OTTONIA THIEMEANA* (Trel.) Yuncker, comb. nov.

Piper Thiemeatum Trel. in Amer. Jour. Bot. 8:214, pl. 5, f. 2. 1921.
Arctottonia Pittieri Trel. in Proc. Amer. Phil. Soc. 73:328. 1934.

Fig. 15. *Ottonia Thiemiana*

A loosely branched, glabrous shrub; flowering internodes rather short and slender; leaves ovate, apex gradually long-acuminate, base somewhat obliquely rounded, subobtuse or shallowly cordate, 3–6.5 cm. wide \times 8–15 cm. long, palmately 5- to 6-nerved, with slender cross-connecting-anastomosing nervules, drying thin, translucent, slightly rugulose; petiole 3–5 mm. long, vaginate below the middle; racemes about 8 mm. thick \times 2–2.5 cm. long; peduncle about 8 mm. long; bracts subspathulate-cupulate, glabrous; pedicels about 2 mm. long; stamens attached at the base of the oblong-ovoid ovary; anthers rather large; ovary somewhat constricted at the apex, glabrous; stigmas commonly 4, short.

Central America.

CANAL ZONE: Alhajuela, May 11–14, 1911, Pittier 3458 (U. S. Nat. Herb., TYPE).

This specimen appears to agree with the type specimen of the Honduran *Piper Thiemeanum* in all respects.

3. POTOMORPHAE Miquel

POTOMORPHAE Miq. in Bull. Sci. Phys. Nat. Neer. 450. 1840; Comm. Phyt. 36. 1840.

Peperidia Kostel. Allg. Med. Pharm. Fl. 2:455. 1831, not Reichenb. 1828.
Lepianthes Raf. Sylva Tellur. 85. 1838, not *Lepanthes* Sw. 1799.
Heckeria Kunth, in Linnaea 13:564. 1839, not Raf. 1838.

Shrubs or large herbs; leaves large and broad, cordate at the base, or peltate; spikes dense, long and slender, umbellate at the end of an axillary peduncle; flowers sessile, perfect, similar to those of *Piper*. A small genus widely distributed in tropical America.

| | |
|----------------------------------|------------------------|
| a. Leaves peltate..... | 1. <i>P. PELTATA</i> |
| aa. Leaves scarcely peltate..... | 2. <i>P. UMBELLATA</i> |

1. POTOMORPHAE PELTATA (L.) Miq. Comm. Phyt. 37. 1840.

Piper peltatum L. Sp. Pl. 30, 1753, sphalm. *peltatum*.
Piper pruinosum H.B.K. Nov. Gen. & Sp. 1:59. 1815.
Piper speciosum H.B.K. loc. cit. 1815.
Peperomia pruinosa Kunth, Pl. Aequin. 1:124. 1822, fide Index Kew.
Peperomia speciosa Kunth, loc. cit. 1822, fide Index Kew.
Piper scutiphllum Ham. Prod. Pl. Ind. Occ. 3. 1825.
Peperomia peltata A. Dietr. Sp. Pl. 1:142. 1831.
Peperomia scutata A. Dietr. loc. cit. 143. 1831.
Piper scrutatum Willd. in A. Dietr. Sp. Pl. 1:143. 1831, as synonym.
Lepianthes peltatum Raf. Sylva Tellur. 85. 1838.
Heckeria peltata Kunth, in Linnaea 13:565. 1839.

Heckeria scutata Kunth, loc. cit. 567. 1839.
Heckeria speciosa Kunth, loc. cit. 568. 1839.
Pothomorphe scutata Miq. Comm. Phyt. 37. 1840.
Pothomorphe speciosa Miq. loc. cit. 1840.
Pothomorphe Ottonis Miq. Syst. Pip. 207. 1843.
Piper Ottonis C.DC. in DC. Prodr. 16¹:332. 1869.
Pothomorphe almirantis Trel. in Ann. Mo. Bot. Gard. 27:306. 1940.
Pothomorphe Baileyorum Trel. loc. cit. 1940.
Pothomorphe Baileyorum var. *paucispica* Trel. loc. cit. 1940.
Pothomorphe tecumensis Trel. loc. cit. 1940.
Pothomorphe tecumensis var. *grandis* Trel. loc. cit. 307. 1940.

Shrub or subshrub, commonly 1-2 m. high; internodes glabrous; leaves rounded-cordate or subdeltoid with retuse base, apex acute, peltate at one-fourth to one-third above the base, mostly with 11-15 nerves radiating from the base of the petiole and usually with one or two pairs arising off the midrib below the middle, the nerves near the margin sparsely to densely short-hairy, and sometimes with a few scattered soft, white hairs above, otherwise glabrous, drying membranous, translucent, yellow-glandular-pellucid-dotted; petiole 9-20 cm. long, vaginately-winged from one-fourth to one-half its length, glabrous; flowering stalks axillary, 4-7 cm. long, glabrous, naked except for the linear-lanceolate bracts at the base of the spikes; spikes umbellate, 2-4 mm. thick \times 5-10 cm. long; peduncles slender, commonly about 10-15 mm. long, glabrous; bracts triangular-peltate, marginally fimbriate; flowers sessile, perfect, 2-androus; fruits minute, obpyramidal-trigonous, stigmas 3, minute, sessile.

Throughout most of the range of the family in the West Indies and the Americas.

BOCAS DEL TORO: Old Bank Island, vicinity of Chiriquí Lagoon, von Wedel 2025; Changuinola Valley, Dunlap 190; Río Cricamola, between Finca St. Louis and Konkintó, alt. 10-50 m., Woodson, Allen & Seibert 1875. CHIRIQUI: Boquete District, Chiquero, alt. 1650 m., Davidson 512; Cerro de la Plata, near San Félix, alt. 120-150 m., Pittier 5160. COCLE: El Valle de Antón, vicinity of Finca Tomás Arias, alt. 600 m., Allen 3619; Llano Bonito, north of Las Margaritas, alt. 400-500 m., Seibert 517. CANAL ZONE: Chagres, Fendler 264; vicinity of Salamanca Hydrographic Station, Río Pequeni, alt. 80 m., Woodson, Allen & Seibert 1573; vicinity of Madden Dam, near Río Chagres, alt. 50-75 m.,

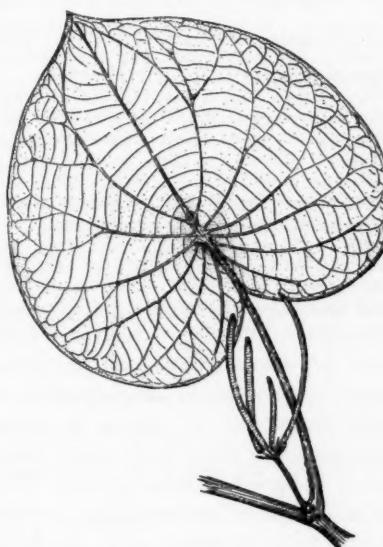


Fig. 16. *Pothomorphe peltata*

Seibert 545; *Gamboa*, *Standley* 28525; *Frijoles*, *Standley* 27619; between *Frijoles* and *Monte Lirio*, alt. 30 m., *Killip* 12117; *Monte Lirio*, *Maxon* 6858; *Las Cascadas Plantation*, near *Summit*, *Standley* 25797; near *Old Fort Lorenzo*, mouth of *Río Chagres*, *Piper* 5929; *Juan Mina*, *Piper* 5689; *Barro Colorado Island*, *Lutz Trail*, *Shattuck* 2; *Kenoyer* 305; *Colón* to *Empire*, *Panama Railroad*, *Crawford* 562; *Gatún Station* on *Panama Railroad*, *Hayes* 243; near *Río Medio*, *Battery 46 Hill*, *Miller* 1774; vicinity of *Fort Sherman*, *Standley* 30069; hills west of the *Canal*, near *Gatún*, *Standley* 27257; *Balboa*, *Standley* 25602; *Balboa Heights*, *Killip* 3064. *COLÓN*: along *Río Sirri*, *Trinidad Basin*, alt. 20–50 m., *Pittier* 4010. *PANAMÁ*: near *Arraiján*, alt. 15 m., *Woodson*, *Allen* & *Seibert* 1398; *Camino de la Granja*, *Bro. Heriberto* 168; *Río Tecúnem*, *Standley* 26735; *Río Tapia*, *Standley* 28062. *DARIÉN*: *Boca de Cupe*, *Williams* 697; vicinity of *Yapé*, alt. 30 m., *Allen* 863; near the mouth of *Río Yapé*, alt. 20 m., *Allen* 342.

2. *POTHOMORPHE UMBELLATA* (L.) Miq. *Comm. Phyt.* 36. 1840.

Piper umbellatum L. *Sp. Pl.* 1:30. 1753.

Piper peltatum Ruiz & Pav. *Fl. Peruv.* & *Chil.* 1:38, *pl. 59.* 1798, not L. 1753.

Piper sidaefolium Link & Otto, *Ic. Pl. Sel. Rar.* 15, *pl. 6.* 1820–28, *fide Index Kew.*

Peperomia umbellata Kunth, *Syn. Pl. Aequin.* 1:124. 1822, *fide Index Kew.*

Peperomia sidaefolia A. Dietr. *Sp. Pl.* 1:141. 1831.

Lepianthes umbellatum Raf. *Sylva Tellur.* 84. 1838.

Heckeria umbellata Kunth, in *Linnaea* 13:569. 1839.

Heckeria sidaefolia Kunth, loc. cit. 1839.

Pothomorphe sidaefolia Miq. *Comm. Phyt.* 36. 1840.

Pothomorphe Dombeyanum Miq. *Syst. Pip.* 211. 1843.

Piper Dombeyanum C.DC. in *D.C. Prodr.* 16¹:332. 1869.

Piper umbellatum var. *majus* C.DC. loc. cit. 333. 1869.

Pothomorphe Alleni Trel. in *Ann. Mo. Bot. Gard.* 27:306. 1940.

A soft-wooded shrub, commonly about 2–3 m. high; flowering internodes from densely rusty-villous to soft-puberulent and commonly more or less hairy in lines; leaves round-ovate or reniform, commonly about 20–25 cm. wide \times 18–20 cm. long, sometimes much larger, apex subacute to acute, base openly cordate, about 13- to 15-nerved from the base, the midrib with 2 or 3 branches 1–3 cm. above the base, more or less puberulent or pubescent on both sides especially along the nerves, glandular-dotted, drying membranous, translucent, pellucid-dotted; petiole up to 20 cm. long, vaginate-winged to about the middle; flowering branches axillary, puberulent, about 15 mm. long, or occasionally up to 4 cm.; spikes umbellate, rather slender, 3–4 mm. thick and up to 10 cm. long; peduncle scarcely 10 mm. long, puberulent; bracts triangular-peltate, marginally ciliate; stamens 2; fruits minute, obpyramidal-trigonous; stigmas 3, sessile.

West Indies and on the mainland from Mexico to Brazil and Peru.

CHIRIQUI: forests around *El Boquete*, alt. 1000–1300 m., *Pittier* 3133. *COCLÉ*: vicinity of *El Valle*, alt. 600–1000 m., *Allen* 1190.

4. *SARCORHACHIS* Trelease

Sarcorhachis Trel. in *Contr. U. S. Nat. Herb.* 26:16. 1927.

Trailing or climbing, rather succulent, glabrous shrubs; leaves alternate; spikes solitary, axillary; stigmas mostly 4, sessile; fruit a small, 1-seeded drupe, partly immersed in and coalescent with the somewhat fleshy rachis at maturity.

1. **SARCORHACHIS NARANJOANA** (C.DC.) Trel. in Contr. U. S. Nat. Herb. 26:17. 1927.

Piper naranjoanum C.DC. in Linnaea 37:363. 1872.

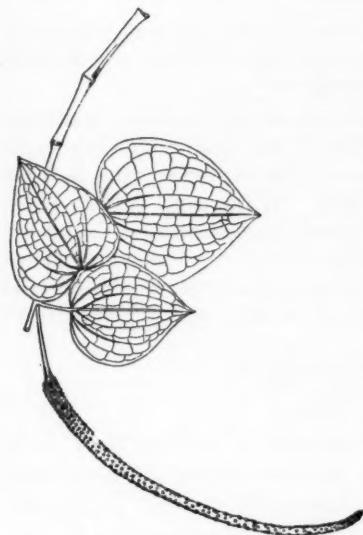


Fig. 17. *Sarcorhachis naranjoana*

Climbing shrub, glabrous; flowering internodes rather short and stout; leaves broadly ovate, apex bluntly short-acuminate, base rounded, truncate, or the lowest subcordate, 6–10 cm. wide \times 8–12 cm. long, subpalmately 7- to 9-nerved, the innermost pair of lateral nerves coalescing with the midrib within the lowermost 1 cm.; petiole 1.5–2.5 or sometimes 4 cm. long, vaginate-winged to shortly above the base of the blade; spikes axillary, about 4–8 mm. thick \times 13–14 cm. long; peduncle 2–3.5 cm. long, surpassing the adjacent petioles; bracts minute, concave; fruits somewhat flattened laterally, partially imbedded in the rachis, glabrous, stigmas 3–5, comparatively large.

Costa Rica and Panama.

DARIÉN: along the Sambú River, above tide limit, Pittier 5562.

This species is quite similar to, if not the same as, *S. incurva* (Sieb.) Trel. of Martinique.

5. ANDERSSONIOPIPER Trelease

ANDERSSONIOPIPER Trel. in Proc. Amer. Phil. Soc. 73:329. 1934.

Soft-wooded shrubs, with flabellately umbellate, axillary spikes, and palmately nerved leaves.

1. **ANDERSSONIOPIPER PANAMENSE** Trel. in Proc. Amer. Phil. Soc. 73:329, *pl. b.* 1934.

Apparently a moderate-sized half-shrub, glabrous; internodes 8 \times 100 mm. long below, shorter and slenderer upward; leaves subreniform, typically abruptly short-acuminate, palmately 13- or 15-nerved with all of the nerves somewhat fine-branched, 10–15 cm. wide \times 9–12 cm. long, drying thin, paler beneath; petiole 3–6 cm. long, winged; spikes 2 (or more?), superposed in the axil, curved, in fruit 10 \times 100 mm.; peduncle scant 2 \times 10 mm.; bracts vague; achenes

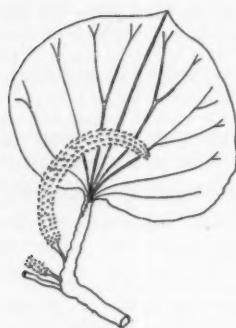


Fig. 13.
Andersoniopiper panamense

[drupes?] obpyramidal, the contracted apex protruding; stigmas 3, broad, sessile.

Panama.

Known only from the type specimen collected by N. J. Andersson, Apr. 1852, now in the Botanical Museum of Stockholm.

No other specimen of this interesting species has been seen, and there is some question regarding its occurrence in Panama. The above description is copied from that of Prof. Trelease who further states: ". . . there are reported contradictions in the labeling of Andersson's collections, so that while its characters are firmly established, the exact geographic source of the genus now named for him requires confirmation."

6. PEPPEROMIA Ruiz & Pavon

PEPPEROMIA Ruiz & Pav., Prodr. Fl. Peruv. 8. 1794.

Prostrate, assurgent or erect, succulent, terrestrial or epiphytic herbs; leaves alternate, opposite, or whorled, simple, entire, sometimes peltate, glabrous or more or less hairy, commonly yellow- or black-glandular-dotted, sessile or petiolate, venation palmate, pinnate, or plinerved with the nerves coalescing toward the base; spikes terminal, axillary, or leaf-opposed, slender, sometimes up to 15 cm. or more long; flowers sessile, in the axils of more or less round, peltate bracts, perfect, perianth none, stamens 2, ovary 1, with obliquely scutelliform, rounded-mammiform, somewhat stylose, or rostrate beak; stigma apical or subapical; fruit very small, globose, ellipsoidal, or subcylindrical, one-seeded, drupe-like, with a thin pericarp and somewhat hardened endocarp, commonly verrucose and viscid.

PRIMARY KEY TO SPECIES OF PEPPEROMIA

- a. Spikes solitary, or few (2-4) on a common stalk, scarcely paniculate.
- b. Leaves scarcely peltate (the margin may join across the petiole in some species).
- c. Fruit essentially sessile.
- d. Fruit and ovary apically more or less mammiform or stylose; stigmas essentially apical.
 - e. Leaves alternate, mostly membranous; fruit lacking a pseudocupule I. Spp. 1-10 (pp. 77-82)
 - ee. Leaves mostly 3-4 at a node (sometimes 2); fruit with a pseudocupule II. Spp. 11-19 (pp. 82-87)
 - dd. Fruit and ovary apically oblique; stigma subapical, anterior.
 - e. Fruit globose-ovoid, short-pointed, subbasally attached III. Spp. 20-47 (pp. 88-102)
 - ee. Fruit ellipsoidal or cylindrical, attached basally, apex obliquely scutelliform or rostrate IV. Spp. 48-57 (pp. 103-111)
- cc. Fruit stipitate V. Sp. 58 (p. 111)
- bb. Leaves distinctly peltate VI. Spp. 59-66 (pp. 112-116)
- aa. Spikes numerous, paniculate VII. Spp. 67-72 (pp. 117-120)

I. KEY TO SPECIES WITH FRUIT ATTACHED BASALLY, LACKING PSEUDOCUPULE, APICALLY MORE OR LESS MAMMIFORM OR STYLOSE, AND WITH STIGMAS APICAL OR SLIGHTLY SUBAPICAL.

(Subgenus *TILDENIA* Miq. in part.).

- a. Leaves pinnately nerved or pli-nerved.
 - b. Margin of floral bracts entire or only slightly irregular.
 - c. Leaves mostly 15 cm. or more long..... 1. *P. ADSCENDENS*
 - cc. Leaves mostly 10-12 cm. or less long..... 2. *P. ACUMINATA*
 - bb. Margin of floral bracts ciliate..... 3. *P. CILIOLIBRACTEA*
 - aa. Leaves palmately nerved or slightly pli-nerved near the base only.
 - b. Leaves and stems glabrous.
 - c. Leaf apex obtuse; stems short; fruit not longitudinally ribbed.
 - d. Leaves 5- to 7-nerved; base cordulate..... 4. *P. BREVIPEDUNCULA*
 - dd. Leaves 9- to 11-nerved; base cordate..... 5. *P. PSEUDO-DEPENDENS*
 - cc. Leaf apex acute; stems erect, branching.
 - d. Midrib obviously branched upward; leaves mostly 1.5-2.5 cm. wide..... 6. *P. PELLUCIDA*
 - dd. Midrib scarcely branched upward; leaves mostly 3 cm. or more wide..... 7. *P. CORDULATIFORMIS*
 - bb. Leaves and petioles hairy.
 - c. Leaves 3-5 cm. or more long.
 - d. Leaves less than 4 cm. wide; spikes much longer than the leaves.... 8. *P. INSUETA*
 - dd. Leaves much wider; spikes shorter than the leaves..... 9. *P. UMBRIGAUDENS*
 - cc. Leaves mostly scarcely 1.5 cm. long, mostly hirtellous..... 10. *P. PANAMENSIS*

1. *PEPEROMIA ADSCENDENS* C.DC. in Jour. Bot. 4:140. 1866.

Peperomia glabra C.DC. loc. cit. 143. 1866.

Peperomia casitana Trel. in Ann. Mo. Bot. Gard. 27:301. 1940.

Peperomia sarcodes Trel. loc. cit. 304. 1940.

A rather large, assurgent, epiphytic or occasionally terrestrial, glabrous herb; stem few-leaved, 5-10 mm. thick when dry, ascending to 10-15 cm. or more, internodes mostly scarcely 10 mm. long, leaf scars large; leaves alternate, broadly oblanceolate, 5-9 cm. wide \times 15-25 or even 30 cm. long, apex acuminate, often abruptly so, base cuneate-decurrent, pinnately nerved, midrib prominent, lateral nerves inconspicuous; petiole 1-4 cm. long, margined by the decurrent blade; spikes terminal, 5 or 6 mm. thick and up to 25 cm. or more long, densely flowered; peduncle 15-20 mm. long, commonly with a small leaf or bract near the middle; floral bracts round-peltate; fruit about 1 mm. long, ellipsoidal, yellow at the base, abruptly and truncately short-pointed; stigma apical.

Northern South America and Central America.

CHIRIQUÍ: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., *Woodson*, *Allen & Seibert* 952; trail from Cerro Punta to headwaters of Rio Caldera, alt. 2250-2500 m., *Allen* 1452; Boquete District, Bajo Chorro, alt. 2250 m., *Davidson* 206.

The large, thick, pinnately nerved leaves, long, thick spikes, and fruit shape distinguish this species.

2. *PEPEROMIA ACUMINATA* Ruiz & Pav. Fl. Peruv. & Chil. 1:32, pl. 51, f. a. 1798,
not *P. acuminata* (L.) Dahlst. 1900.

Piper acuminatum Pers. Syn. 1:35. 1805, not *P. acuminatum* L. 1753.

Piper nemorosum Vahl, Enum. Pl. 1:341. 1805.

Peperomia pyrifolia H.B.K. Nov. Gen. & Sp. 1:61. 1815.

Peperomia basellaeifolia H.B.K. loc. cit. 66. 1815.

Piper basellaeifolium Poir. in Lam. Encycl. Meth. 4:Suppl. 468. 1816.
Piper murinum Roem. & Schult. Syst. Veg. 1:325. 1817.
Piper pyrifolium D. Dietr. Encycl. 122. 1831, not *P. pyrifolium* Vahl. 1805.
Peperomia nemorosa C.DC. in DC. Prodr. 16¹:413. 1869.
? *Peperomia dicthrophylla* Sodiro, Contr. Conoc. Fl. Ecuador. Monogr. 1. ed. 2. 157. [1901].
Peperomia Ruiziana C.DC. in Candollea 1:301. 1923.
Peperomia Ekmani Trel. in Fedde. Rep. Sp. Nov. 23:31. 1926.
Peperomia acuminatifolia Trel. in Contr. U. S. Nat. Herb. 26:48. 1927.
Peperomia oblaceaefolia Trel. in Badillo in Cat. Fl. Venez. 1:245. 1945, name only.

An assurgent, simple or sparingly branched, glabrous, succulent herb; stem 4-5 or sometimes 10 mm. thick when dry, ascending from the decumbent, rooting base to 60 cm. or more in large specimens; internodes 1-3 or 4 cm. long, leaf scars large, nodes commonly more or less tumid; leaves alternate, elliptic, lanceolate or oblanceolate, 2-4 cm. wide \times 6-13 cm. long, apex attenuate and sharply more or less arcuately acuminate, base cuneate, decurrent, pinnately nerved, drying coriaceous and subopaque, commonly minutely dark-dotted and glandular beneath, minutely ciliolate at the apex; petiole 5-10 mm. long, or occasionally 15-20 mm. on lower leaves, more or less winged by the decurrent blade; spikes solitary, terminal, closely flowered, 3-4 mm. thick \times 10-13 cm. long; peduncle 3-5 cm. long, sometimes with a small leaf or bract; floral bracts round-peltate; fruit about 1 mm. long, ellipsoidal, abruptly and truncately scutellate, sometimes yellowish at the base, stigma apical.

West Indies, Panama, and northern South America.

PANAMA: without locality, *Hayes* 817.

3. *PEPEROMIA CILIOLIBRACTEA* C.DC. in Candollea 1:360, 383. 1923.

A moderate-sized, assurgent herb; stem 3-4 mm. thick, ascending to 15 cm. or more from the decumbent, rooting base, velvety pubescent; internodes scarcely 1 cm. long, nodes somewhat tumid, leaf-scars large; leaves alternate, oblong-ovate or subobovate, apex shortly sharp-acuminate, base rounded, cordulate to acute, mostly 2-5 cm. wide \times 5-8 cm. long, occasionally up to 7 \times 14 cm., puberulent on both sides, rather densely so along the nerves beneath, ciliolate, 9- to 11-plinerved, the uppermost lateral nerves branching off the midrib near the middle, drying membranous, translucent, reddish-glandular-dotted beneath; petiole 2-5 or sometimes up to 8 cm. long, velvety; spikes 2 mm. thick \times 10-14 cm. long, closely flowered; peduncle up to 5 cm. long, velvety; bracts round-peltate, reddish-glandular-dotted, marginally more or less ciliate; fruit about 1 mm. long, subglobose, apex pointed, slightly oblique, stigma essentially apical, basal part of the fruit yellowish, upper half reddish with reddish-glandular dots.

Panama.

CANAL ZONE: Las Cascadas Plantation, near Summit, *Standley* 25731; Barro Colorado, *Stevens* 637; Wheeler Trail, *Sattuck* 214. PANAMÁ: Chararé River near Chepo, alt. 50-200 m., *Pittier* 4712.

The plinerved leaves, velvety stems, leaves, etc., short internodes, and shape of fruit are distinctive of this species.

4. *PEPEROMIA BREVIPEDUNCULA* Trel. in Contr. U. S. Nat. Herb. 26:43. 1927, not *P. Heydei* var. *brevipeduncula* C.DC.

A short, rhizomatous, leafy, glabrous herb; stem ascending 6-8 cm. from a fibrous-rooted, somewhat contorted-nodulose (when dry) rhizome about 4 mm. thick, internodes up to 10 mm. long; leaves alternate, round, round-ovate, or elliptic-ovate, apex rounded or slightly pointed, base cordulate or shallowly cordate, 4.5-6 cm. wide and occasionally up to 9.5 cm. long, palmately 5-nerved, or large leaves 7-nerved with the outermost laterals slender and indistinct, nerves sparingly branched upward, drying dull, membranous, translucent, pellucid-dotted; petiole 2-6 cm. long, clasping; spikes opposite the upper leaves, and axillary, rather stout, 2-3 mm. thick \times 8-15 cm. long, rather loosely flowered; peduncle 5-15 mm. long; bracts round-peltate, glandular-dotted; fruit globose, about 1 mm. long, apex mammiform, stigma apical.

Southern Panama.

DARIÉN: Boca de Panarandó, on Sambú River, alt. 20 m., Pittier 5590.

When Trelease described this species he considered it as being the same as *P. Heydei* var. *brevipeduncula*, which is now believed to be *P. pseudo-dependens*. It differs from that species because of its fewer-nerved leaves with cordulate rather than cordate base. From *P. Heydei* it differs in the shape of the fewer-nerved leaves, shorter peduncles, etc.

5. *PEPEROMIA PSEUDO-DEPENDENS* C.DC. in Jour. Bot. 4:137. 1866.

Peperomia Heydei C.DC. var. *brevipeduncula* C.DC. in Ann. Conserv. & Jard. Bot. Genève 21:247. 1920.

Peperomia brevipeduncula (C.DC.) Trel. var. *major* Trel. in Ann. Mo. Bot. Gard. 27:301. 1940.

A short-stemmed, glabrous, succulent, few-leaved herb, perennial from a small corm; leaves alternate, round-ovate, up to 11 cm. in diameter, apex obtuse or subacute, base deeply cordate, palmately 9- to 11-nerved, the nerves forked upward, drying very thin and translucent; petiole up to 10 cm. long, mostly about 5-7 cm.; spikes terminal and axillary, rather loosely flowered, 2-3 mm. thick and up to 14 cm. long; peduncle 7-10 or even 20 mm. long; bracts round-peltate, red-glandular-dotted; fruit about 1 mm. long, globose-ovoid, sulcate ventrally toward the base, apex mammiform, stigma apical.

Venezuela, northern Colombia, and Panama.

PANAMÁ: Río Las Lajas, alt. 20 m., Allen 2037.

6. *PEPEROMIA PELLUCIDA* (L.) H.B.K. Nov. Gen. & Sp. 1:64. 1815.

Piper pellucidum L. Sp. Pl. 30. 1753.

Piper concinnum Haw. Rev. Pl. Succ. 198. 1821.

Peperomia concinna A. Dietr. Sp. Pl. 1:164. 1831.

Micropiper pellucidum Miq. Comm. Phyt. 54. 1840.

Peperomia pellucida var. *pygmaea* Willd. Herb. ex Miq. Syst. Pip. 81. 1843.

Peperomia pellucida var. *minor* Miq. in Mart. Fl. Bras. 4:10. 1852.

A rather delicate, erect, glabrous, pellucid, branched herb; stem up to 5 mm. thick near the base and 50 cm. tall; leaves alternate, round-deltoid-ovate, mostly 15–25 mm. wide, apex somewhat attenuate, acute, base subtruncate-cordate, palmately 5-nerved, drying very thin, semi-transparent; petiole mostly 1–2 cm. long, clasping-decurrent; spikes terminal, axillary, or leaf-opposed, slender, 2–5 cm. long, very loosely flowered; peduncle about 5 mm. long; bracts round-peltate; fruit about 0.8 mm. long, ellipsoidal, longitudinally more or less sulcately striate; apex pointed, stigma apical.

A common weedy species occurring throughout the West Indies and tropical North and South America. It is also found in the Old World tropics and Pacific Islands.

PANAMA: without locality, *Bro. Heriberto* 78. BOCAS DEL TORO: vicinity of Nievecita, alt. 0–50 m., *Woodson*, *Allen* & *Seibert* 1866; vicinity of Chiriquí Lagoon, *von Wedel* 1256; lower Changuinola River, *Stork* 1. CANAL ZONE: Balboa, *Standley* 25827, 27159; *Foster* s. n.; Gatún, *Cowell* 292; Summit, *Stevens* 325; *Standley* 26905; Ancón, alt. 2080 m., *Pittier* 3902; Ancón Hill, *Stevens* 794. COLÓN: Chagres, *Fendler* 302; vicinity of Porto Bello, alt. 5–10 m., *Pittier* 2469. PANAMÁ: Chepo, alt. 60 m., *Pittier* 4450; Las Sabanas, *Standley* 25950; Taboga Island, *Standley* 27063, 27881; Perlas Archipelago, San José Island, *Johnston* 126, 178. SAN BLAS: vicinity of Puerto Obaldia, alt. 0–50 m., *Pittier* 4370.

This species, together with the East Indian *P. exigua*, constituted the subgenus OGMOCARPIDIUM of Dahlstedt.

7. PEPPEROMIA CORDULATIFORMIS Trel. in Bot. Gaz. 73:143. 1922.

An ascending, glabrous, rather large herb; stem 3–4 mm. thick when dry, ascending to 50 cm. or more, freely and widely branching, internodes up to 10 cm. long, rooting from the lower nodes; leaves alternate, round-ovate, apex bluntly short-acute, not at all bristly, base rounded, cordate, scarcely peltate as originally described, 3–5 cm. wide \times 4–6 cm. long, smaller upward in young growth, palmately 5- to 7-nerved, the midrib scarcely branched upward, drying membranous, translucent, glandular-dotted; petiole up to 5 cm. long on larger, lower leaves, reduced upward with smaller uppermost leaf petioles 5 mm. long, channelled above, clasping-decurrent; spikes leaf-opposed, 1 mm. thick \times 4–5 cm. long, rather loosely flowered; peduncle 5–10 mm. long; bracts round-peltate, glandular-dotted; fruit globose-ovoid, about 0.5 mm. long, apex scarcely oblique, stigma essentially apical.

Canal Zone.

CANAL ZONE: Mamei Hill, alt. 20–90 m., on rocks, *Pittier* 3806; vicinity of Madden Dam, near Río Chagres, alt. 50–75 m., on banks of brook and in water, *Seibert* 553; Alajuela, rocks along Chagres River, *Pittier* 3467.

Trelease described the leaves as "obscurely subpeltate." The margin, however, does not meet over the petiole in the type specimen. It differs from *P. cordata* because of its smaller, non-peltate leaves, and character of fruit. It rather closely resembles *P. pellucida* in many respects but differs because of its usually larger leaves in which the midrib is scarcely branched upward.

8. *PEPEROMIA INSUETA* Trel. in Ann. Mo. Bot. Gard. 27:303. 1940.

A rather small, terrestrial, acaulescent herb; leaves arising from a short, thickened, rhizome-like base, elliptic, apex obtuse, base obtuse, cordulate, or subacute, 2-4 cm. wide \times 4-7.5 cm. long, moderately to sparsely crisp-pubescent above, moderately crisp-pubescent beneath, more densely so along the nerves, scarcely ciliate, palmately 5-nerved, or large leaves with an additional pair of slender nerves at the base, the innermost pair of nerves appearing to coalesce with the midrib within the lowermost 5 mm., the midrib and lateral nerves branched upward, drying darker above, paler beneath, membranous, translucent, glandular-dotted beneath; petiole 3-8 cm. long, crisp-pubescent; spikes 1.5 mm. thick \times 6-12 cm. long, rather closely flowered; peduncle about equilong, crisp-pubescent; rachis pubescent at the base and with a few, scattered hairs above; bracts round-peltate, glandular-dotted; fruit about 0.6 mm. long, globose, stigma apical or at most only slightly subapical.

Panama.

COCLÉ: vicinity of El Valle, alt. 600-1000 m., Allen 1220. CANAL ZONE: Quebrada Ancha, alt. 70 m., Dodge & Steyermark 17061; Steyermark & Allen 17061a.

The acaulescent plants, long-petiolate, elliptic leaves with pubescent blades and petioles, long spikes on long peduncles, and somewhat pubescent rachises are distinctive characters of this species.

9. *PEPEROMIA UMBRIGAUDENS* Yuncker, sp. nov.

Herba succulenta rhizomatosa; foliis alternis, rotundato-ovatis usque ad 11 cm. latis, apice obtusis vel subacutis, basi profunde cordatis, sinu aperto, palmatim 11-nerviis supra sat dissite villosis subtus ad venas plus conferte villosis; petiolo usque ad 15 cm. longo, sat gracili, proximo laminae villoso, deorsum glabratu; spicis solitariis; pedunculo ca. 6 cm. longo, dissite villoso; ovario subturbinato, apice submammiformi, stigmate apicali interdum bifido.

A rhizomatous, succulent, shade-loving herb; leaves alternate, few, clustered at the end of a fleshy, fibrous-rooted rhizome 5-10 mm. thick when dry, round-ovate, apex obtuse or obscurely acutish, base deeply cordate with open sinus, up to 11 cm. in diameter, palmately 11-nerved, the nerves strongly forked upward, rather sparsely villous above, more densely so along the nerves beneath, drying thin, translucent, finely pellucid-dotted, paler and prominently glandular-dotted beneath; petiole up to 15 cm. long, rather slender, villous near the blade, glabrescent downward; spikes solitary, terminal (?) or axillary (?), 2 mm. thick \times 6 cm. long, closely flowered; peduncle equilong, thinly villous; bracts round-peltate; ovary subturbinate, apex submammiform, stigma apical, sometimes bifid.

Known only from the type locality.

PANAMA: Cerro Trinidad, on moist boulders in deep shade, alt. 800-1000 m., Oct. 20, 1946, Allen 3766 (Herb. Missouri Bot. Gard., TYPE).

This species resembles *P. pseudo-dependens* in some respects but differs because of the pubescence of the leaves, petioles, and peduncles, longer peduncles, etc.

10. *PEPEROMIA PANAMENSIS* C.DC. in Candollea 1:329. 1923.

A small, spreading, stoloniferous epiphyte; stem branched, 1 mm. thick, fruiting branches ascending to 5 cm., internodes mostly 1-3 cm. long, minutely hirtellous; leaves alternate, suborbicular, round-ovate, or occasionally elliptic-subovate, 6-14 mm. wide \times 8-20 mm. long, apex rounded, acute at the very base, palmately 3- to 5-nerved, both sides glabrous or sparsely minutely hirtellous, ciliolate toward the apex; petiole 3-8 mm. long, mostly about 5 mm., sulcate above, clasping, glabrous or minutely hirtellous; spikes terminal and axillary, 2 mm. thick \times 10-15 mm. long, closely flowered; peduncles mostly 5-8 mm. long, sparsely minutely hirtellous or glabrate; bracts round-peltate; fruit about 1 mm. long, basally immersed or eventually on pseudopedicels, subturbinate-cylindrical, apically mammiform, stigma apical.

Panama and northern South America.

COCLÉ: mountains beyond La Pintada, alt. 400-600 m., *Hunter & Allen* 574. CANAL ZONE: in forest along the Río Indio de Gatún, near sea-level, *Pittier* 2789.

The minutely hirtellous, repen stems, rounded leaves, short spikes, and shape of fruit characterize this species.

II. KEY TO SPECIES MOSTLY WITH OPPOSITE OR VERTICILLATE LEAVES; FRUIT STYLOSE AND WITH A PSEUDOCUPULE.

(Subgenus *MICROPIPER* (Miq.) Dahlst.)

- a. Leaves scarcely 10-12 mm. long, apex scarcely protracted.
b. Rachis puberulent..... 11. *P. REFLEXA* var. *AMERICANA*
- bb. Rachis not puberulent.
 - c. Stems and leaves glabrous; leaves longer than wide, commonly whorled..... 12. *P. QUADRIFOLIA*
 - cc. Stems and leaves more or less hairy.
 - d. Leaves in whorls of 4, round or obovate-elliptic..... 13. *P. QUATERNATA*
 - dd. Leaves mostly opposite, orbicular..... 14. *P. CYCLOPHYLLA*
- aa. Leaves mostly 10-20 mm. or more long.
 - b. Leaves about 10-20 mm. long, opposite, apex scarcely narrowed..... 15. *P. QUADRANGULARIS*
 - bb. Leaves mostly much longer, or whorled and constricted toward the apex.
 - c. Stem hirtellous; leaves bluntly constricted-pointed; peduncle 4-5 cm. long..... 16. *P. BOCASENSIS*
 - cc. Stem essentially glabrous, or, if hirtellous, leaves larger, narrowly pointed.
 - d. Leaf apex minutely hirtellous; leaves drying rather thin, 3 central nerves prominent..... 17. *P. MARTAGONIFOLIA*
 - dd. Leaf apex glabrous.
 - e. Spikes densely flowered, commonly 6-8 cm. long; bracts contiguous or overlapping; leaves drying coriaceous opaque; spikes often multiple..... 18. *P. SEEMANNIANA*
 - ee. Spikes loosely flowered, commonly 10 cm. or more long; bracts mostly remote; leaves drying membranous, translucent, spikes mostly solitary..... 19. *P. VIRIDISPICA*

11. *PEPEROMIA REFLEXA* (L. f.) A. Dietr. var. *AMERICANA* (Miq.) Dahlst. in Kgl. Sv. Vet.-Akad. Handl. 33²:175. 1900.

Peperomia reflexa f. *americana* Miq. Syst. Pip. 173. 1843.

Peperomia reflexa var. *enervulosa* C.DC. in DC. Prodr. 16¹:452. 1869, in part (?).

Peperomia americana Herter in Rev. Sudamer. Bot. 6:150. 1940.

A somewhat caespitose or repent, branched, spreading, succulent, epiphytic herb; stems 1-2 mm. thick, fruiting branches ascending up to about 5 cm., internodes variable, commonly 1-4 cm. long, drying angular-grooved, hirtellous-subvillous, the hairs often rather scattered, stiffish, and of varying lengths, up to 1 mm. long; leaves mostly in whorls of 4, rhombic-ovate, ovate, elliptic or suborbicular, commonly 5-10 mm. wide \times 8-15 mm. long, apex rounded or slightly contracted, base acutish, glabrous above, loosely subvillous beneath, obscurely palmately 3-nerved, drying coriaceous and subopaque; petiole mostly 1-2 mm. long, subvillous; spikes terminal, densely flowered, 2 mm. thick \times 1-3 cm. long; peduncle up to 2-3 cm. long, loosely subvillous; rachis ridges hispid; bracts round-peltate; fruit immersed in pits, about 1 mm. long, subcylindrical, with basal pseudocupule, apex conical, stigma apical.

West Indies and on the mainland from Mexico through Central America and northern South America.

CHIRIQUI: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., *Woodson*, *Allen & Seibert* 879; Chiriquí Volcano, Boquete District, alt. 2100 m., *Davidson* 875; El Potrero Camp, alt. 2600 m., *Killip* 3603; Río Caldera, above El Boquete, alt. 1300-1350 m., *Killip* 3512; valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300-1900 m., *Seibert* 147; near Los Siguas Camp, southern slope of Cerro de la Horqueta, alt. 1700 m., *Maxon* 5539.

Plants which are believed to represent the typical form of this species have stems minutely subreflexed-hirtellous with the hairs only 0.1-0.2 mm. long. The contrast in pubescence appears to hold in all of the specimens examined and is the chief character upon which the variety is based.

12. *PEPEROMIA QUADRIFOLIA* (L.) H.B.K. Nov. Gen. & Sp. 1:69. 1815.

Piper quadrifolium L. Sp. Pl. ed. 2. 1:43. 1762.

Troxirum quadrifolium Raf. Sylva Tellur. 85. 1838.

Peperomia subquadrifolia Trel. in Contr. U. S. Nat. Herb. 26:43. 1927.

A small, glabreus, árboricolous herb; stem 1.5-2 mm. thick, repeatedly forking, rooting from the lower nodes, drying yellowish, somewhat scaly, angular; leaves in whorls of 3-7 but commonly 4 at a node, obovate, oblong-obovate, or obovate-elliptic, emarginate, the notch bristly-hairy, base acute to subcuneate, 5-8 mm. wide \times 8-14 mm. long, obscurely palmately 3-nerved, drying coriaceous, opaque, narrowly subrevolute; petiole 1-2 mm. long, channelled above, occasionally microscopically hirtellous; spikes terminal, closely flowered, 1.5 mm. thick \times 2-3 cm. long; peduncle 1-2 cm. long, comparatively slender; bracts round-peltate; rachis pitted; fruit obliquely ovoid, about 1 mm. long, acutely narrowed into a short, stout style, with basal pseudocupule, stigma apical.

Mountains of Chiriquí province and elsewhere throughout Central America, the West Indies, and northern South America.

CHIRIQUI: Volcán de Chiriquí, vicinity of Casita Alta, alt. about 1500-2000 m., *Woodson*, *Allen & Seibert* 815, 972; eastern slope, Camp Aguacatal, alt. 2400-2500 m., *Maxon* 5298; vicinity of Cerro Punta, alt. 2000 m., *Allen* 1532; valley of the upper Río Chiriquí

Viejo, vicinity of Monte Lirio, alt. 1300-1900 m., *Seibert 148*; Bajo Mona, mouth of Quebrada Chiquero, along Río Caldera, alt. about 1500-2000 m., *Woodson, Allen & Seibert 1024*; humid forest around Los Siguas Camp, southern slope of Cerro de la Horqueta, alt. 1700 m., *Maxon 5539*; alt. 1700 m., *Pittier 3197, 5539*; Río Piarnasta Valley, 5 miles east of El Boquete, alt. 1525-1600 m., *Cornman 3534*; vicinity of El Boquete, alt. 1000-1300 m., *Maxon 5013*; Dexter Trail, El Boquete, *Killip 3534*.

The glabrous stems and leaves, shape, size and arrangement of the leaves, and rather long terminal peduncles characterize this species. No consistent difference has been noted by which *P. subquadrifolia* can be maintained as a distinct species.

13. *PEPEROMIA QUATERNATA* Miq. in Seem. Bot. Voy. Herald, 197. 1854.

A small, low, compactly and divaricately branched, succulent herb; stem sparingly hirsute; leaves in whorls of 4, round- or obovate-elliptic, rounded at both ends, scarcely 7 mm. wide \times 10 mm. long, revolute, impressed-punctate, sparingly hirsute beneath, palmately 3-nerved; petiole 1-2 mm. long, retrorsely hispid; spikes terminal, closely flowered, scarcely 2 cm. long; peduncle 1 cm. long, hirsute; bracts round-peltate, golden- or red-glandular; rachis glabrous; fruit not known.

Panama and (?) adjacent South America.

CHIRIQUÍ: Volcano Chiriquí, *Seemann 895*.

14. *PEPEROMIA CYCLOPHYLLA* Miq. in Mart. Fl. Bras. 4¹:219. 1852, name only; Seemann, Bot. Voy. Herald, 198. 1854.

A small, repent, more or less crisp-pilose herb; stem about 1 mm. thick when dry, branching, internodes mostly 1-2 cm. long; leaves opposite, orbicular, mostly 5-10 mm. in diameter, occasional leaves 3-5 mm., pilose-pubescent on both sides, commonly slightly peltate, or the margin scarcely continuous over the petiole, loosely ciliate, drying coriaceous, subopaque, nerves scarcely evident or faintly palmately 3-nerved; petiole mostly about 1 mm. long, sparsely crisp-pubescent; spikes terminal or axillary, 1 mm. thick \times 3-6 cm. long; peduncle 2-bracteate at or above the middle, crisp-pubescent, bracts linear or spatulate, pubescent; floral bracts round-peltate; fruit ovoid, pointed, stigma terminal.

Costa Rica and Panama. Also, in closely related forms, in the West Indies and South America.

PANAMA: without locality, *Seemann 607*. CHIRIQUÍ: forests around Puerto Remedios, alt. 0-30 m., *Pittier 3381*. VERAGUAS: trail between Cañazas and the foot of the Cordillera Central, headwaters of Río Cañazas, alt. 300-600 m., *Allen 149*. CANAL ZONE: western slope of Ancón Hill, vicinity of Balboa, alt. 20-75 m., *Seibert 123*; vicinity of Gatunillo, *Piper 5652*; Río Pedro Miguel, near East Paraíso, *Standley 29987*. PANAMÁ: second growth, near Pacora River, *Miller 1775*; near big swamp east of Río Tecumén, *Standley 26542*; Río Tapia, *Standley 26195, 30670*; between Matías Hernández and Juan Díaz, *Standley 31938*; Chorrera, *Killip 3408*; swamp between El Jagua Hunting Club on Río Jagua and El Congor Hill, alt. 2 m., *Hunter & Allen 487*. DARIÉN: trail between Pinogana and Yavisa, alt. about 15 m., *Allen 252*.

15. *PEPEROMIA QUADRANGULARIS* (Thomps.) A. Dietr. Sp. Pl. 1:169. 1831.

Piper quadrangulare Thomps. in Trans. Linn. Soc. 9:202, pl. 21, f. 1. 1808.

Peperomia angulata H.B.K. Nov. Gen. & Sp. 1:66. 1815.

Piper angulatum Poir. in Lam. Encycl. Meth. 4:Suppl. 468. 1816.

Piper quadrangulum Willd. herb. fide Miq. Syst. Pip. 180. 1843.

Peperomia angulata var. *orbicularis* Dahlst. in Kgl. Sv. Vet.-Akad. Handl. 33²:157. 1900.

Peperomia Carlo-Wrightii Trel. in Fedde Rep. Sp. Nov. 23:23. 1926.

Peperomia Allenii Trel. in Ann. Mo. Bot. Gard. 25:825. 1938.

Peperomia saginans Trel. in Badillo in Cat. Fl. Venez. 1:246. 1945, nomen nudum.

A comparatively small, repent herb, epiphytic or on rocks; stem quadrangular, 1–2 mm. thick, minutely hirtellous to glabrate; leaves opposite, or occasionally roots replacing one of the leaves, rarely ternate, elliptic, obovate, or orbicular, 10–22 mm. wide \times 12–30 mm. long, apex obtuse or very slightly pointed, base acute to rounded, palmately 3-nerved, nerves impressed above and more or less salient beneath, drying coriaceous and subopaque, sparsely hirtellous or glabrate, more or less variegated when living; petiole 2–4 mm. long, hirtellous; spikes axillary or occasionally terminal, 2–3 cm. long; peduncles 2–4 cm. long, 2-bracteate near the middle, hirtellous; floral bracts round-peltate, glandular-dotted; fruit ovoid, stigma at the apex of a short, thick style.

West Indies, Panama, and northern South America.

DARIÉN: trail between Pinogana and Yavisa, alt. about 15 m., Allen 262.

The specimen on which *P. Allenii* was based is rather fragmentary. It agrees in all respects, so far as can be determined, however, with those taken to represent this species from northern South America and Cuba.

16. *PEPEROMIA BOCASENSIS* Trel. in Ann. Mo. Bot. Gard. 27:300. 1940.

A repent-assurgent, red-tinged, succulent, epiphytic herb; stems about 2 mm. thick and sulcate when dry, internodes 2–7 cm. long, crisp-hirtellous; leaves in whorls of 3–4, elliptic, apex constricted, obtuse, base subobtuse or acute, 1–2 cm. wide \times 1.5–3.5 cm. long, mostly about 1.5 \times 2.5 cm., palmately 3-nerved, crisp-hirtellous above, especially along the nerves, glabrous beneath, ciliolate toward the apex, punctate, drying coriaceous, glossy, opaque; petiole hirtellous, channeled; spikes axillary and (?) terminal, 1 mm. thick \times 7–11 cm. long, closely flowered; peduncle 4–5 cm. long, hirtellous; rachis with inter-ovary, anastomosing ridges; bracts round-peltate; fruit subglobose, about 1 mm. long, obliquely pointed into a stoutish style, stigma terminal.

Known only from Bocas del Toro.

BOCAS DEL TORO: vicinity of Nievecita, stem and peduncles deep red, alt. about 0–50 m., Woodson, Allen & Seibert 1859.

The hirtellous stems and upper surface of the blades, long spikes, and long peduncles distinguish this species.

17. *PEPEROMIA MARTAGONIFOLIA* C.DC. in Ann. Conserv. & Jard. Bot. Génève 21:262. 1920, name only; in Candollea 1:313. 1923; Schroeder in Candollea 3:128. 1926.

An erect, somewhat branched or simple, essentially glabrous, fleshy, terrestrial, or epiphytic herb; stem up to 4 mm. thick below when dry, internodes commonly 3-4 cm. long above, the lowermost 15 cm., drying strongly ridged; leaves mostly 3-4 at a node, lance-elliptic, apex sharply long-acuminate, base acute-decurrent, 2-3.5 cm. wide \times 5-9 cm. long, palmately 5-nerved, the midrib and innermost pair of nerves prominent, the apex minutely hirtellous, drying dull green, submembranous, subrevolute, translucent; petiole 1-2 cm. long, glabrous, or sparsely microscopically hirtellous; spikes terminal and axillary, closely flowered, 2 mm. thick \times 10-14 cm. long; peduncle mostly 8-15 mm. long, glabrous or microscopically hirtellous; rachis reticulately ridged between the flowers; bracts very small, round-peltate; fruit ovoid, obliquely pointed, about 1 mm. long, with basal pseudocupule, stigma apical.

Mountains of Costa Rica and northern Panama.

CHIRIQUI: Cuesta de las Palmas, southern slope of Cerro de la Horqueta, alt. 1700-2100 m., Pittier 3269; Bajo Chorro, Boquete District, alt. 1800 m., Davidson 199.

The conspicuous nerves, hirtellous leaf apices, lengths of petioles and peduncles, small bracts, etc. distinguish this species from *P. Seemanniana* and other related forms.

18. *PEPEROMIA SEEMANNIANA* Miq. in Seem. Bot. Voy. Herald, 198, pl. 37. 1854.

A glabrous, branched, suberect, terrestrial herb; stem 3-4 mm. thick when dry, 15-30 cm. or more tall, internodes 2-3 cm. long above, much longer downward, drying ridged-sulcate; leaves commonly opposite, less frequently ternate, lance-elliptic, occasional leaves oblanceolate or suboblong, apex attenuately sharp-acuminate, base acute-decurrent, 2-3 cm. wide \times 6-10 cm. long, palmately 5- to 7-nerved, drying coriaceous, glandular-dotted, opaque; petiole 5-10 mm. long, grooved above, stout; spikes terminal and axillary, commonly multiple, 2 mm. thick \times 6-8 cm. long, densely flowered; peduncle mostly 1-2 cm. long; bracts ovate-oblong-peltate, contiguous or overlapping; fruit globose-ovoid, pointed, stigma apical.

Northern Panama.

CHIRIQUI: vicinity of El Boquete, alt. 1000-1300 m., Pittier 2921; Maxon 5037; alt. 1400-1650 m., Killip 3542; Bajo Mono, Boquete District, alt. 1350 m., Davidson 556; Chiriquí Volcano, Seemann 896.

19. *PEPEROMIA VIRIDISPICA* Trel. in Contr. U. S. Nat. Herb. 26:44. 1927.

Peperomia angustata H.B.K. var. *santamartae* C.DC. in Candollea 1:306. 1923.

Peperomia viridispica var. *perejil* Trel. Contr. U. S. Nat. Herb. 26:44. 1927.

Peperomia sarcocarpa Trel. loc. cit. 1927.

A rather large, repent, pendent, glabrous, succulent, epiphytic herb; stem 3-5 mm. thick when dry \times 30 cm. or more long, rooting at the lower nodes, drying

angular-sulcate, internodes mostly 3–6 cm. long, occasionally up to 10 cm.; leaves 2–4 at a node, more commonly opposite, subrhombically lance-elliptic, oblanceolate, or rounded, 1.5–4 cm. wide \times 3–7 cm. long, apex attenuately acuminate, blunt, base acute or subcuneate, drying submembranous, translucent, palmately 3- to 5-nerved, if 5-nerved the outermost pair of laterals thin and obscure; petiole 5–10 mm. long; spikes terminal or occasionally axillary, commonly solitary, loosely flowered, 2–3 mm. thick \times 8–15 cm. long or occasionally somewhat longer; peduncle 1–5 cm. long; bracts oblong-ovate-peltate; fruit globose-ovoid, about 1 mm. long, obliquely pointed, stigma apical.

Panama and Colombia.

COCLÉ: Penonomé and vicinity, alt. 15–300 m., Williams 382. CANAL ZONE: Balboa, Standley 27117, 28550, 28568; vicinity of former town Empire, Culebra Cut and vicinity, alt. 80 m., Hunter & Allen 785; on boulders in deep shade, Allen 2028. PANAMÁ: Taboga Island, Macbride 2808; Standley 27893; Tumba Muerto Road, near Panamá, Standley 29827; between Las Sabanas and Matías Hernández, Standley 31873, 31893; near Pacora River, Miller 1776, 1777, 1778; hills northeast of Hacienda La Joya, 50–300 m., Dodge, Hunter, Steyermark & Allen 16902.

No significant difference has been found by means of which the Panamanian specimens can be differentiated from those seen from Colombia. The distantly spaced flowers and usually more membranous (when dry) leaves distinguish it from *P. Seemanniana*.

III. KEY TO SPECIES WITH GLOBOSE-OVOID, SUBBASALLY ATTACHED FRUIT
WITH OBLIQUE SOMEWHAT POINTED APEX AND SUBAPICAL STIGMA.

(Subgenus *SPHAEROCARPIDIUM* Dahrlst.).

- a. Leaves opposite or verticillate (lower stem leaves sometimes alternate).
- b. Stems minutely velvety hirtellous.
 - c. Leaves 5 mm. or less wide, 3 times or more longer than wide.
 - d. Leaves scarcely 2 mm. wide, linear-oblong..... 20. *P. APODA*
 - dd. Leaves 2–5 mm. wide.
 - e. Leaves spatulate, much longer than wide..... 21. *P. GALIOIDES*
 - ee. Leaves elliptic, scarcely twice longer than wide..... 37. *P. ALBESCENS*
 - cc. Leaves wider and proportionately shorter..... 22. *P. PALMANA*
- bb. Stem not hirtellous.
 - c. Stems glabrous; leaves commonly alternate, subplinerved..... 23. *P. ALLAGOTACTA*
 - cc. Stems more or less hairy.
 - d. Stems villous, at least toward the base.
 - e. Leaves 4–7 mm. wide..... 24. *P. BIFRONS*
 - ee. Leaves 10–20 mm. wide..... 25. *P. VALLICULAE*
 - dd. Stems villous at the nodes only.
 - e. Leaves mostly 3–4 at a node..... 26. *P. BARBINODIS*
 - ee. Leaves 2 or 1 at a node..... 27. *P. SEIBERTII*
- aa. Leaves alternate.
 - b. Rachis conspicuously papillate, plants subcaulescent..... 28. *P. KILLIPI*
 - bb. Rachis not obviously papillate.
 - c. Leaves scarcely 1 cm. long, or occasionally up to 2 cm., plants repent.
 - d. Leaves 2–3 mm. wide, oblong-spatulate..... 29. *P. NIEVECITANA*
 - dd. Leaves mostly wider, rounded, elliptical, or lanceolate.
 - e. Leaves or some of them 2–3 times longer than wide.
 - f. Stem essentially glabrous or with only a few scattered hairs; leaves ve y variable in shape..... 30. *P. CHIRIQUIENSIS*
 - ff. Stem evidently hairy.
 - g. Leaves elliptic-obovate, apex round-emarginate..... 31. *P. HYGROPHILOIDES*
 - gg. Leaves narrowly elliptic, apex acute..... 32. *P. CHRYSLERI*

- ee. Leaves mostly scarcely twice as long as wide.
 - f. Spikes scarcely 5 mm. long..... 33. *P. COCLEANA*
 - ff. Spikes mostly 1-2 cm. or more long.
 - g. Leaves, or some of them, elliptic or lance-elliptic, subacute.
 - h. Stems villous..... 34. *P. CRUENTATA*
 - hh. Stems minutely hirtellous..... 35. *P. TENUICAULIS*
 - gg. Leaves mostly round, elliptic, or subobovate, obtuse.
 - h. Plants long-repant, leaves all alternate..... 36. *P. ROTUNDIFOLIA*
 - hh. Plants subcepsitose, leaves congested 2-3 together above..... 37. *P. ALBESCENS*
- cc. Leaves usually much larger.
 - d. Leaves conspicuously black-dotted.
 - e. Leaves elliptic-lanceolate, or ovate, mostly broader at or below the middle..... 38. *P. GLABELLA*
 - ee. Leaves elliptic-ob lanceolate, mostly wider above the middle.
 - f. Leaves hairy on both sides; spikes about 15 cm. long..... 39. *P. FLAGELLISPICA*
 - ff. Leaves glabrous; spikes shorter..... 40. *P. PERCUNEATA*
 - dd. Leaves not obviously black-dotted though sometimes dark-glandular.
 - e. Stems glabrous (or somewhat pilose at the nodes only).
 - f. Inner nerves coalescing within the lowermost 5-10 mm.; leaves more or less elliptic-ob lanceolate.
 - g. Spikes 3 cm. or more long..... 41. *P. DIRUPTORUM*
 - gg. Spikes 1 cm. long; peduncle equilong..... 23. *P. ALLAGOTACTA*
 - ff. Nerves not obviously coalescent.
 - g. Leaves 2.3-4.5 cm. wide.
 - h. Plants ascending scarcely 20 cm.; leaves abruptly and bluntly short-acuminate, nervules by transmitted light numerous and anastomosing..... 42. *P. PASCUICOLA*
 - hh. Plants to 1 m. tall; leaves, at least above, narrowly attenuately sharp-acuminate, nervules not conspicuously numerous or strongly anastomosing..... 43. *P. ELATA*
 - gg. Leaves mostly 2 cm. or less wide.
 - i. Leaves less than twice as long as wide..... 44. *P. LEUCOSTICTA*
 - ii. Leaves 2-3 times longer than wide.
 - j. Nodes more or less pilose; upper leaves opposite..... 27. *P. SEIBERTII*
 - jj. Nodes glabrous; upper leaves alternate..... 45. *P. PARIETARIAEFOLIA*
 - ee. Stems hairy.
 - f. Leaves mostly less than 2 cm. wide.
 - g. Plants ascending 10-15 cm.; stems villous upward..... 46. *P. OBSCURIFOLIA*
 - gg. Plants ascending to 30 cm. or more; stems villous downward, glabrescent above..... 25. *P. VALLICULAE*
 - ff. Leaves mostly 2-3.5 cm. wide, obtuse..... 47. *P. DAVIDSONII*

20. *PEPEROMIA APODA* Trel. in Contr. U. S. Nat. Herb. 26:44. 1927.

A small, stoloniferous herb; stem 2 mm. thick below when dry, rooting at the lower nodes; branches 1 mm. thick, ascending 5-8 cm., densely velvety-hirtellous; internodes mostly less than 1 cm. long; leaves mostly 4 at a node, oblong, apex rounded, sometimes emarginulate with bristle-like hairs, base acute, 2 mm. wide \times 10 mm. long, glabrous on both sides or sparsely hirtellous near the base above, ciliolate near the base, 1-nerved, conspicuously yellow-glandular-dotted, drying firm, opaque; petiole about 0.5 mm. long, flat, hirtellous, marginally ciliolate; spikes terminal (?) and axillary, slender, 1 mm. thick \times 4 cm. long, moderately flowered; peduncle 1-2 mm. long; bracts comparatively large, round-peltate, yellow-glandular-dotted; fruit ovoid, about 0.6 mm. long, apex rather acutely and obliquely pointed, stigma subapical.

Río Caldera valley, Chiriquí.

CHIRIQUÍ: valley of the Río Caldera, from El Boquete to the Cordillera, alt. 1400-1600 m., Killip 3514.

The densely hirtellous stems, whorled, narrowly oblong, glandular-dotted leaves, and obliquely, rather sharp-pointed fruits distinguish this species.

21. *PEPEROMIA GALIOIDES* H.B.K. Nov. Gen. & Sp. 1:71, *pl. 17*. 1815.

Piper galoides Poir. in Lam. Encycl. Meth. 4:Suppl. 470. 1816.

Peperomia suaveolens Ham. Prodr. Pl. Ind. Occ. 2: 1825, fide C.D.C.

?*Peperomia Mollugo* Willd. in Miq. Syst. Pip. 156. 1843, as synonym.

Peperomia flagelliformis Hook. f. ex Miq. in Hook. Lond. Jour. Bot. 4:423. 1845.

Peperomia Jamesoni Regel in Bull. Soc. Nat. Moscou 31²:544. 1858.

Peperomia agapetensis C.D.C. in DC. Prodr. 16¹:455. 1869.

Peperomia galoides var. *longifolia* C.D.C. loc. cit. 464. 1869.

Peperomia galoides var. *nigro-punctulata* C.D.C. loc. cit. 1869.

Peperomia galoides var. *umbrose* Henschen in Nov. Act. Soc. Sci. Upsal. III, 8:37. 1873.

Peperomia galoides var. *apraca* Henschen, loc. cit. 1873.

Peperomia subcorymbosa Sodiro, Contr. Conoc. Fl. Ecuador. Monogr. 1. ed. 2. 181. [1901].

Peperomia galoides var. *minutifolia* C.D.C. in Ann. Conserv. & Jard. Bot. Genève 21:262.

1920.

Peperomia granata Trel. in Fedde Rep. Sp. Nov. 23:24. 1926.

A suberect, branched, succulent, epiphytic or terrestrial herb; stem 2-3 or rarely 8 mm. thick, up to 100 cm. long but mostly much shorter, branching di- or trichotomous or verticillate, the branches often slender, wand-like, and commonly rather strongly divergent, moderately to densely hirtellous; leaves 3-9 at a node, commonly 4-5, elliptic, elliptic-oblong, subspatulate, or oblanceolate, 2-5 mm. wide \times 5-30 mm. long, apex obtuse, base acute, obscurely palmately 3-nerved or subpinerved, the midrib faintly branched upward, commonly more or less puberulent along the midrib at least near the base above and sometimes slightly so beneath, ciliolate toward the apex, often glandular-dotted, drying membranous; petiole very short, hirtellous; spikes terminal and axillary, solitary or in verticels of 3-6 spikes, 4-7 or rarely up to 15 cm. long; peduncle mostly about 5 or occasionally up to 10 mm. long, glabrate or sparsely hirtellous; bracts round-peltate; fruit about 1 mm. long, globose-ovoid, apex oblique, stigma subapical.

Nearly throughout the range of the genus in the Americas and the West Indies.

CHIRIQUÍ: Chiriquí Volcano, alt. 2450 m., Killip 3585.

This species does not appear to be common in Panama. The only specimen seen comes from the heights on Chiriquí Volcano. This specimen has leaves slightly more hirtellous than is common for the South American specimens and it appears more dingy when dry and with the leaves slightly more opaque. No other characters of any significance have been observed, however, by which it can be distinguished from this species.

22. *PEPEROMIA PALMANA* C.D.C. in Bull. Soc. Bot. Belg. 29²:71. 1890; 30¹:233. 1891.

Peperomia palmana var. *glabrior* C.D.C. in Candollea 1:304. 1923.

Peperomia glabrior Trel. in Contr. U. S. Nat. Herb. 26:44. 1927.

Peperomia laesa Trel. in Ann. Mo. Bot. Gard. 27:402. 1940.

An erect or subassurgent, freely branching, terrestrial or epiphytic herb; stem 2-3 mm. thick toward the base when dry, up to 20-30 cm. tall, rooting from the lowermost nodes, moderately to densely velvety-hirtellous, internodes 3-5 cm. long below, reduced upward; leaves 2, 3, or 4 at a node, rather variable in size and shape, often on the same plant, elliptic, lance-elliptic, suborbicular or obovate, apex bluntly acuminate, base acute, 0.8-2.0 cm. wide \times 1-5 cm. long, commonly 1-1.5 \times 3-4 cm., very obscurely hirtellous on one or both sides, glabrescent, ciliolate toward the apex, distinctly palmately 3-nerved or the broader leaves 5-nerved, drying thin and translucent, glandular-dotted, somewhat pellucid-dotted; petiole up to 15 mm. long, mostly 5-10 mm., velvety-hirtellous; spikes axillary, 1-2 mm. thick \times 2-6 cm. long, closely flowered; peduncle slender, hirtellous glabrescent; bracts round-peltate, rather conspicuously dark-glandular-dotted; fruit subglobose, about 0.5 mm. long, apex oblique, stigma subapical.

Costa Rica and western Panama.

CHIRIQUI: vicinity of Casita Alta, Volcán de Chiriquí, alt. about 1500-2000 m., *Woodson, Allen & Seibert* 876, 971; vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, alt. 1800-2000 m., *Allen* 1422; valley of the Upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300-1900 m., *Seibert* 144, 149; Boquete District, Bajo Chorro, alt. 1800 m., *Davidson* 178; above El Boquete, alt. 1400-1500 m., *Killip* 3519; vicinity of El Boquete, alt. 1000-1500 m., *Cornman* 2052; between the Río Ladillo and Los Siguas Camp, southern slope of Cerro de la Horqueta, alt. 1200-1700 m., *Maxon* 5401, 5541, 5553; Cuesta de la Palmas, southern slope of Cerro de la Horqueta, alt. 1700-2100 m., *Pittier* 3217.

In the original description of this species DeCandolle said that the leaves and young stems were slightly puberulous, while he described variety *glabrior* in the Clavis as having glabrous stems. Trelease, later, in raising var. *glabrior* to specific status, likewise claimed that the plants representing the variety were glabrous. He also described *P. laesa* as glabrous. The type specimen of var. *glabrior* has definitely hirtellous stems and some of the leaves are likewise obscurely hirtellous. The type of *P. laesa* also shows the same characters. The leaves on the type of var. *glabrior* are somewhat larger than is common for other specimens cited here but this character is so variable that it does not appear advisable to use it for varietal distinction.

23. *PEPEROMIA ALLAGOTACTA* C.DC. in *Candollea* 1:317, 378. 1923.

A rather small, erect, fleshy, glabrous herb; stem 3-4 mm. thick when dry, 20 cm. or more tall, branched upward, the branches slender, divergent, internodes about 1 cm. long, those of the branches somewhat longer, drying wrinkled and subglossy; leaves alternate, those of the branches appearing opposite because of congestion, elliptic, elliptic-lanceolate, or suboblong-lanceolate, apex somewhat narrowed but obtuse, base acute, 7 mm. wide \times 2 cm. long, or those on the main stem 1.5 \times 4.5 cm., 5-plinerved, the laterals coalescing with the midrib near the base, the midrib branched upward, ciliolate toward the apex, glandular-dotted, drying membranous, translucent, paler beneath; petioles 2-5 mm. long, grooved above; spikes terminal, closely flowered, 1 mm. thick \times 1 cm. long; peduncle about as

long as the spike; bracts round-peltate, about 0.5 mm. wide, glandular-dotted; ovary ovoid, apex oblique, stigma subapical; matured fruit not present.

Chiriquí Volcano.

CHIRIQUÍ: around El Potrero Camp, Chiriquí Volcano, alt. 2800-3000 m., Pittier 3108.

The plinerved leaves, congested and simulating an opposite or whorled arrangement on the branches, and short spikes characterize this species.

24. *PEPEROMIA BIFRONS* Trel. in Ann. Mo. Bot. Gard. 27:300. 1940.

A medium-sized, assurgent herb, branching from the base, simple above; stem 3-4 mm. thick when dry, rather densely villous when young, becoming glabrous above in older stems, drying sulcate and somewhat glossy, internodes mostly 1-3 cm. long; leaves mostly 3 or 4 at a node, oblong-elliptic or subob lanceolate, apex obtuse or subemarginulate, base cuneate, 4-7 mm. wide \times 1.5-3 cm. long, glabrous on both sides, ciliate toward the apex, obscurely palmately 3-nerved, drying rather firm, opaque, glandular-dotted beneath; petioles 2-5 mm. long, glabrous, flattened above, clasping-decurrent; spikes terminal and axillary, 2 mm. thick \times 3.5 cm. long, rather closely flowered; peduncle comparatively thick, 1-2 cm. long, glabrous; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical; mature fruit not present.

Known only from one locality in Chiriquí.

CHIRIQUÍ: Finca Lerida to Boquete, alt. about 1300-1700 m., Woodson, Allen & Seibert 1132.

25. *PEPEROMIA VALLICULAE* Trel. in Ann. Mo. Bot. Gard. 24:186. 1937.

A rather large, assurgent herb; stem 3-5 mm. thick below when dry, ascending to 30 cm. or more, villous toward the base, glabrescent upward, internodes 3-4 cm. long below, reduced upward; leaves alternate or sometimes 2 or 3 at a node, subrhombically oblanceolate, apex blunt, emarginulate, base cuneate, 1-2 cm. wide \times 2.5-5 cm. long, rather obscurely palmately 3-nerved, glabrous on both sides, ciliolate toward the apex, dark-glandular-dotted, drying firm and opaque, paler beneath; petiole 5-10 mm. long, grooved above, glabrous, clasping-decurrent; spikes terminal and axillary, 1 mm. thick \times 10-18 cm. long, closely flowered; peduncles 1-2 cm. long, glabrous; bracts round-peltate, glandular-dotted; fruit ovoid, about 0.5 mm. long, apex oblique, stigma subapical.

Known only from Cerro Valle Chiquito, Coclé.

COCLÉ: western slope and summit of Cerro Valle Chiquito, alt. 700-800 m., Seibert 503.

The stems villous downward, alternate-opposite-whorled, oblanceolate leaves, and long spikes are distinguishing characters of this species.

26. *PEPEROMIA BARBINODIS* Trel. in Contr. U. S. Nat. Herb. 26:200. 1929.

Peperomia chiqueroana Trel. in Ann. Mo. Bot. Gard. 27:301. 1940.

A rather large, erect, openly branching herb; stem 3-4 mm. thick below when dry, up to 30 cm. or more tall, glabrous except for the prominently villous nodes,

internodes 10 cm. long below, somewhat shorter upward; leaves 2, 3, or 4 at a node, elliptic, elliptic-lanceolate, or subob lanceolate, apex acuminate, base acute, 1-2 cm. wide \times 3.5-6 cm. long, glabrous and paler beneath, the nerves above crisp-pubescent, densely ciliolate toward the apex, 5-nerved, the midrib and innermost pair of lateral nerves prominent, the outermost pair inconspicuous, coalescing near the base, drying membranous, translucent, faintly glandular-dotted; petiole about 5 mm. long, glabrous, grooved above; spikes terminal and axillary, loosely flowered, very slender, 6 cm. long; peduncle about 1 cm. long, glabrous; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical.

Costa Rica and western Panama.

CHIRIQUÍ: Bajo Mona, mouth of Quebrada Chiquero, along Río Caldera, alt. about 1500-2000 m., Woodson, Allen & Seibert 1025.

The type, *Tonduz 10419*, from Costa Rica, has leaves smaller than the Panamanian collection cited above, but otherwise the specimens appear to be nearly identical.

27. *PEPEROMIA SEIBERTII* Trel. in Ann. Mo. Bot. Gard. 24:185. 1937.

A moderately large, openly branched, essentially glabrous herb, drying yellow; stem 3 mm. thick below when dry, up to 30 cm. or more tall, somewhat villous at the nodes, internodes up to 10 cm. long below, reduced upward; leaves both alternate and opposite, broadly lanceolate, apex sharply acuminate, base acute, 1-2.5 cm. wide \times 2.5-6 cm. long, palmately 3- to 5-nerved, the midrib and innermost pair of lateral nerves salient beneath, pale-glandular-dotted and glabrous beneath, pubescent at the base above, ciliate toward the apex, drying membranous, translucent; petiole scarcely 5 mm. long, grooved above, atately decurrent; spikes terminal and axillary, 1 mm. thick \times 5-7 cm. long, loosely flowered; peduncle slender, 5-10 mm. long; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical; fruit not present.

Near Monte Lirio, Chiriquí.

CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300-1900 m., Seibert 201.

The alternate-opposite leaf arrangement, leaves pubescent at the base above, and pilose nodes distinguish this species.

28. *PEPEROMIA KILLIPI* Trel. in Bot. Gaz. 73:143. 1922.

Peperomia hymenodes Trel. in Contr. U. S. Nat. Herb. 26:43. 1927.

A small, very short-stemmed herb; stem 3 mm. thick, subrhizomatous, ascending 2-3 cm., glabrous, internodes very short, drying wrinkled and scaly; leaves alternate, round- to elliptic-ovate, apex acute or obtusish, base cordate or cordulate, 1.5-3.5 cm. wide \times 3-6 cm. long, sparsely appressed-pubescent above, glabrous beneath, rather densely ciliolate throughout, palmately 7-nerved, drying very thin, translucent, pale glandular-dotted; petioles very slender, commonly 3-5 cm. long, glabrous or sparsely pubescent along the groove, abruptly enlarging into a thick-

ened base which remains as part of the stem when the leaf falls off; spikes apparently axillary, 1 mm. thick \times 5–9 cm. long, closely flowered; peduncles up to 5.5 cm. long, glabrous; rachis ridges conspicuously papillate; bracts round-peltate, granulate; fruit ovoid, scarcely 0.5 mm. long, apex oblique, stigma subapical.

Panama.

CHIRIQUÍ: eastern Chiriquí, vicinity of San Felix, alt. 0–120 m., Pittier 5266. CANAL ZONE: Rio Paraíso, above East Paraíso, Standley 29890; Canal Zone and adjacent Panama, forest along small, unnamed quebrada entering lake at 70 m. level, alt. 70–80 m., Rio Indio, Dodge & Allen 17290; sabanas along drowned Rio Azote Caballo, alt. 66–70 m., Dodge, Steyermark & Allen 16867; near Madden Dam and along Azote Caballo Road near Alahuela, alt. 90–100 m., Dodge 16587. COLÓN: Alhajuela, Chagres River, Killip 3218; between Alhajuela and El Vigia, Pittier 2369. PANAMÁ: Rio La Maestra, alt. 0–25 m., Allen 38; Perlas Archipelago, San José Island, Johnston 443, 1138.

The leaves on the type specimen are round-ovate with obtusish apex while those on the type of *P. hymenodes* are elliptic-ovate with acutish apex. Other specimens show intergrading shapes. The very short stem, long, slender petioles and peduncles, and especially the strongly papillate rachis are distinctive features. It resembles *P. bipidorbachis* in general but differs in its sparser pubescence, less hispid rachis, and the shape of the fruit.

29. *PEPEROMIA NIEVECITANA* Trel. in Ann. Mo. Bot. Gard. 27:304. 1940.

A small, matted, repent-assurgent epiphytic herb; stem scarcely 1 mm. thick, fertile branches up to 5 cm. tall, crisp-pubescent, internodes short; leaves alternate, oblong-spatulate, apex obtuse, base acutish, 2–3 mm. wide \times 6–8 mm. long, glabrous, somewhat ciliolate toward the apex, glabrescent, glandular-dotted, inconspicuously 1-nerved, drying dark, opaque; petioles 1 mm. long, glabrous, flattened; spikes terminal, scarcely 1 mm. thick \times 2–3 cm. long, moderately flowered; peduncle slender, about 5 mm. long, sparsely pubescent glabrescent; bracts round-peltate; fruit globose-ovoid, scarcely 0.5 mm. long, apex oblique, stigma subapical.

Vicinity of Nieveleta, Bocas del Toro.

BOCAS DEL TORO: vicinity of Nieveleta, alt. 0–50 m., Woodson, Allen & Seibert 1865.

The repent, pubescent stems, alternate, small, glabrous, spatulate leaves, and small fruits distinguish this species.

30. *PEPEROMIA chiriquiensis* Yuncker, sp. nov.

Herba parva repens stolonifera, caule filiformi glabro vel dissite pubescente; foliis alternis elliptico-subobovatis, ovato-oblongis vel lanceolato-oblongis, apice rotundatis, basi acutis, obscure palmatim 3-nerviis, glabris vel supra dissite pubescentibus, ciliatis; petiolo 2–4 mm. longo amplectenti-decurrente; spicis terminalibus et (?) axillaribus; pedunculo 5–10 mm. longo, glabro; drupa globosa, apice obliqua, stigmate subapicali.

A rather small, repent-stoloniferous herb; stem scarcely 1 mm. thick, branching, fruiting branches ascending to 5 cm., rooting from the nodes, essentially glabrous, with a few widely scattered hairs, internodes about 2 cm. long, reduced on the fruiting branches; leaves alternate, very variable in size and shape, those on the

stolons elliptic-subobovate, 4–7 mm. wide \times 5–10 mm. long, apex rounded, base acute, those on the erect shoots becoming ovate- or lance-oblong and up to 1.5–2 cm. long, rather obscurely palmately 3-nerved, the midrib impressed above, glabrous or sparsely pilose above, paler and glandular-dotted beneath, ciliate especially above the middle, drying rather thin, translucent; petiole 2–4 mm. long, clasping-decurrent; spikes terminal and (?) axillary, 1 mm. thick \times 3–4 cm. long, rather loosely flowered; peduncle 5–10 mm. long, glabrous; bracts round-peltate; fruit globose, eventually on pseudopedicels, apex oblique, stigma subapical.

Known only from the type locality.

CHIRIQUI: humid forest above Camp I, Holcomb's Trail, above El Boquete, alt. 1800–2100 m., Feb. 18, 1918, Killip 3564 (U. S. Nat. Herb., TYPE).

This species bears some resemblance to *P. Jamesoniana* of Ecuador and Colombia but differs in the shape of the non-emarginate, glandular-dotted leaves.

31. *PEPEROMIA HYGROPHILOIDES* C.DC. in Candollea 1:329. 1923.

A small, repent, branching, epiphytic herb; stem 1 mm. thick, creeping on trees, crisp-pubescent, scurfy-exfoliating, internodes 1–2 cm. long, much reduced on the short, erect, fertile branches; leaves alternate or the very uppermost opposite, elliptic-obovate, apex rounded or emarginate, base acutish, 5–8 mm. wide \times 8–13 mm. long, much reduced upward on fertile branches, crisp-puberulent above, glabrous and conspicuously brown-glandular-dotted beneath, ciliate toward the apex, obscurely palmately 3-nerved, the midrib faintly nerved upward, drying firm, subtranslucent; petiole 3–5 mm. long, filiform, glabrous or sparsely puberulent; spikes terminal on short axillary branches, 1 mm. thick \times 2–2.5 cm. long, closely flowered; peduncle 5–8 mm. long, glabrous; bracts round-peltate; fruit globose, apex oblique, stigma subapical.

Southern slope of Cerro de la Horqueta, Chiriquí.

CHIRIQUI: southern slope of Cerro de la Horqueta, vicinity of Las Siguas Camp, alt. 1700 m., Pittier 3203.

This species is apparently closely related to *P. rotundifolia* from which it differs because of the type of pubescence and the shape of the leaves.

32. *PEPEROMIA Chryslerii* Yuncker, sp. nov.

Herba parva stolonifera, ramis fructiferis ad 5 cm. adscendentibus dissite villosis; foliis alternis, oblongo-ellipticis, utrinque acutis, utrinque glabris, apicem versus ciliolatis; petiolo 2–3 mm. longo, villosi; spicis terminalibus; pedunculo 1 cm. longo, crispe-pubescente; ovario oboviedo, apice obliqua, stigmate subapicali.

A small, stoloniferous herb; stem 1 mm. thick, fertile branches ascending to 5 cm., loosely villous, internodes about 1 cm. long; leaves alternate, elliptic-oblong, acute at both ends, about 5 mm. wide \times 15–20 mm. long, 1-nerved, glabrous on both sides or with a few hairs near the base above, ciliolate toward the apex, paler and pale-glandular-dotted beneath, drying subcoriaceous and subopaque; petiole

2-3 mm. long, villous; spikes terminal, 1 mm. thick \times 7 cm. long, moderately flowered; peduncle about 1 cm. long, crisp-pubescent; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical; fruit not matured.

Known only from the type locality.

CANAL ZONE: Barro Colorado Island, June 29, 1940, M. A. Chrysler 4797 (Herb. Univ. Ill., TYPE).

The small plants with villous stems, and leaf shape distinguish this species.

33. *PEPEROMIA COCLEANA* Trel. in Ann. Mo. Bot. Gard. 25:826. 1938.

A small, repent herb; stem less than 1 mm. thick, glabrous, branching, the fruiting branches 1-2 cm. long, internodes mostly less than 1 cm. long; leaves alternate, round, apex obtuse, base acutish, scarcely 5 mm. wide, loosely pilose above, glabrous beneath, ciliate, faintly 1-nerved, drying thickish, subtranslucent, apparently fleshy when living; petiole 1-2 mm. long, glabrous; spikes 1 mm. thick \times 2-4 mm. long, densely flowered, terminal and axillary on short, axillary branches; peduncle scarcely 5 mm. long, glabrous; bracts round-peltate; fruit subdepressed-globose, scarcely 0.5 mm. long, apex bluntly and slightly oblique, stigma nearly apical.

Upper Río Mata Ahogado valley, Coclé.

COCLÉ: valley of the upper Río Mata Ahogado, alt. 350 m., Allen 133.

The small, round leaves, glabrous filiform stem, and especially the very small spikes, distinguish this species from *P. rotundifolia* which it superficially resembles.

34. *PEPEROMIA CRUENTATA* Trel. in Ann. Mo. Bot. Gard. 27:302. 1940.

A small, repent herb; stem filiform, moderately to densely villous, branches up to 5 cm. tall; internodes up to 1 cm. long; leaves alternate, crimson between the veins when fresh, round or subobovate, apex rounded, base acutish, those on the branches elliptic or lance-elliptic, acute at both ends, the rounded lower leaves about 5 mm. in diameter, the upper leaves 3-5 mm. wide \times 8-14 mm. long, palmately 3-nerved, glabrous on both sides or with occasional hairs above, rather strongly ciliate, drying membranous, translucent, inconspicuously glandular-dotted; petiole 1-2 mm. long, grooved above, more or less hairy; spikes terminal on short, erect, few-leaved shoots, 1 mm. thick \times 3-4 cm. long, rather closely flowered; peduncle about 5 mm. long, villous, the hairs extending on the rachis above the lowermost several flowers; bracts round-peltate, densely glandular-dotted; fruit scarcely 0.5 mm. long, globose, apex oblique, stigma subapical.

Isla de Colón, Bocas del Toro.

BOCAS DEL TORO: Isla de Colón, alt. 25-75 m., Woodson, Allen & Seibert 1941.

Trelease cited Woodson, Allen & Seibert 1938 first when he originally described this species. The specimen in the Missouri Botanical Garden Herbarium of this number, which would presumably be taken as the type, is rather meagre and does not show the characters of the species as given in the description. It appears to be more properly a specimen of *P. rotundifolia* to which it is now being referred. The

above description is drawn from No. 1941 of the same collectors, and the specimen in the Missouri Botanical Garden as sheet No. 1170515 is taken to be the type. The label on this specimen gives the data as cited above. A specimen, obviously of the same collection and carrying the same number in the New York Botanical Garden Herbarium gives the location as Rio Cricamola, between Finca St. Louis and Konkintoë, Bocas del Toro, alt. 10-50 m., Aug. 12-16, 1938.

The villous plants, elliptic leaves, and rachis pubescent toward the base distinguish this species from *P. rotundifolia* with which it is obviously related.

35. *PEPEROMIA TENUICAULIS* C.DC. in Anal. Inst. Fis.-Geogr. Costa Rica 9:177. 1897.

A slender-stemmed, repent herb; stem filiform, less than 1 mm. thick, branching, minutely hirtellous, internodes mostly about 1-1.5 cm. long; leaves alternate, ovate-elliptic, apex acute or obtuse, base subpeltate with the margin barely continuous over the petiole, or acutish, palmately 3-nerved, the nerves slender, puberulent on both sides, ciliolate near the apex, glandular-dotted, drying thin, translucent; petiole filiform, 1-2 mm. long, shallowly grooved above, minutely hirtellous; spikes terminal, 1 mm. thick \times 3-5 cm. long, densely flowered; peduncle less than 5 mm. long, minutely hirtellous, with 2 small, lanceolate bracts near the middle, the bracts bristly at the apex; floral bracts round-peltate; fruit subglobose, about 0.6 mm. long, apex oblique, stigma subapical.

Costa Rica and Panama.

CANAL ZONE and ADJACENT PANAMA: drowned forest of quebrada below Rio Indio Hydrographic Station, alt. 70 m., Steyermark 17387.

36. *PEPEROMIA ROTUNDIFOLIA* (L.) H.B.K. Nov. Gen. & Sp. 1:65. 1815.

Piper rotundifolium L. Sp. Pl. 30. 1753.

Piper nummularifolium Sw. Prodr. Veg. Ind. Occ. 16. 1788.

Peperomia nummularifolia H.B.K. loc. cit. 66. 1815.

Acropardipodium nummularifolium Miq. in Versl. en Medel. Kon. Nederl. Inst. 198, pl. 2. 1843.

?*Peperomia rotundifolia* f. *ovata* Dahlst. in Kgl. Sv. Vet.-Akad. Handl. 33²:101. 1900.

Peperomia rotundifolia var. *subglabrilimba* C.DC. in Candollea 1:326. 1923.

Peperomia rotundifolia var. *subelliptica* Trel. in Fedde Rep. Sp. Nov. 23:18. 1926, nomen nudum.

A small, repent herb; stem filiform, scarcely 1 mm. thick, fruiting branches short, erect, moderately crisp-puberulent or somewhat villous glabrescent; leaves alternate, round, about 5 mm. in diameter, or round-elliptic or subovate and up to 10 mm. wide \times 12 mm. long, apex obtuse, base rounded-subpeltate with the lower margin scarcely continuous over the petiole, or sub-acute, moderately crisp-puberulent, loosely villous, or commonly glabrescent, more or less ciliate, obscurely palmately 3-nerved, often glandular-dotted, drying membranous; petiole commonly 1-5 mm. long, or occasionally up to 10 mm.; spikes solitary, scarcely 1 mm. thick \times 2 cm. long, or occasionally somewhat longer, terminating short branches which commonly bear 1-3 or 4 leaves reduced in size upward; peduncle 3-5 mm. or rarely

up to 10 mm. long, crisp-puberulent or glabrate; bracts round-peltate; fruit about 0.8 mm. long, globose-ovoid, apex oblique, stigma subapical.

Throughout the American range of the genus in numerous scarcely distinguishable forms.

BOCAS DEL TORO: vicinity of Nievecita, alt. 0-50 m., *Woodson, Allen & Seibert 1847*; Isla de Colón, alt. 25-75 m., *Woodson, Allen & Seibert 1938*; Changuinola Valley, *Dunlap 455*; vicinity of Chiriquí Lagoon, *von Wedel 1137*. CHIRIQUÍ: valley of the Río Piarnasta, about 5 mi. east of El Boquete, alt. 1525-1600 m., *Killip 3537*; Boquete District, Chiquero, alt. 1650 m., *Davidson 510*. CANAL ZONE: near Río Medio, *Miller 1733, 1741*; Barro Colorado Island, alt. 120 m., *Standley 40901*; *Kenoyer 301*; Bohio, Soldado, *Cowell 225*; around Frijoles, alt. 25-30 m., *Pittier 3759*. COLÓN: Río Fató, alt. 10-100 m., *Pittier 3888*. DARIÉN: Caña-Cuasi Trail, Chepigana Distr., alt. 600 m., *Terry & Terry 1443*.

The variation in size and shape of the leaves is considerable on some specimens. The pubescence also is quite variable. Both crisp-puberulent and villous leaves may sometimes occur on the same plant.

37. *PEPEROMIA ALBESCENS* Trel. in Ann. Mo. Bot. Gard. 27:299. 1940.

A small, repent, subcespitoso herb; stem 1 mm. thick, rooting at the nodes, erect branches up to 5 cm. tall, subretroserely velvety-puberulent; internodes 1-2 cm. long below, shorter upward; leaves alternate or congested above and 2 or 3 together, broadly elliptic or subobovate, apex rounded, base acutish, 3-6 mm. wide \times 5-10 mm. long, sparsely hirtellous glabrescent on both sides, bristly hairy at the apex, inconspicuously 1-nerved, drying firm, whitish, opaque; petiole 2-3 mm. long, subretroserely puberulent; spikes terminal, often somewhat curved, 1 mm. thick \times 10-15 mm. long, densely flowered; peduncle 5-10 mm. long, sparsely puberulent; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical; mature fruit not present.

Coclé.

COCLÉ: vicinity of El Valle, alt. 600-1000 m., *Allen 1259*.

The small plants, small, elliptic, alternate-opposite-whorled leaves, and short spikes characterize this species. It is to be distinguished from *P. rotundifolia* because of the habit of growth, type of pubescence, crowded branch leaves, etc.

38. *PEPEROMIA GLABELLA* (Sw.) A. Dietr. Sp. Pl. 1:156. 1831.

Piper glabellum Sw. Prodr. Veg. Ind. Occ. 16. 1788.

Piper scandens Sw. loc. cit. 1788, not Vahl.

Peperomia brachyphylla A. Dietr. loc. cit. 157. 1831.

Peperomia caulibarbis Miq. Syst. Pip. 98. 1843.

Peperomia lineatipila A. Rich. in La Sagra, Fl. Cub. 11:229. 1850.

Peperomia trinervis Ruiz & Pav. var. *brachyphylla* C.DC. in DC. Prodr. 16¹:417. 1869.

Peperomia caulibarbis var. *brachyphylla* (A. Dietr.) Dahlst. Kgl. Sv. Vet.-Akad. Handl. 33²:120. 1900.

Peperomia glabella var. *brachyphylla* (A. Dietr.) C.DC. in Urb. Symb. Ant. 3:236. 1902.

?*Peperomia chagalana* C.DC. in Engl. Bot. Jahrb. 40:259. 1908.

?*Peperomia sublaxiflora* C.DC. loc. cit. 262. 1908.

Peperomia similis Britt. in Mem. Torrey Bot. Club 16:61. 1920.
Peperomia cubana C.DC. f. *platana* Trel. in Fedde Rep. Sp. Nov. 23:19. 1926.
Peperomia lineatipila f. *mogotana* Trel. loc. cit. 1926.
Peperomia leucandra Trel. in Contr. U. S. Nat. Herb. 26:46. 1927.
Peperomia fusco-ciliata Trel. loc. cit. 1927.

A black-glandular-dotted, stoloniferous-assurgent herb; stem 1-2 mm. thick, branches ascending to 15 cm. or more, glabrous except for the ciliate petioles and lines decurrent from their margins below the nodes; leaves ovate to ovate-elliptic-lanceolate, 8-13 mm. wide \times 15-35 mm. long, or occasionally up to 2.5 \times 6 cm., acute to acuminate at both ends or not infrequently blunt or subobtuse, palmately 3- to 5-nerved, or plinerved within the lowermost 5-7 mm., ciliated near the apex, or some leaves throughout, mostly drying dark and subopaque; petiole 5-10 mm. long, grooved above, clasping-decurrent, mostly crisp-ciliate; spikes terminal and from the upper leaf axils, slender, up to 5-8 or occasionally as much as 12 cm. or more long; peduncle 10-15 mm. long; bracts round-peltate, black-dotted; fruit globose-ovoid, apex oblique, somewhat scutelliform and scutellum commonly with a thin margin, stigma subapical.

West Indies, Central America, and northern South America, in various scarcely distinguishable forms.

PANAMA: without locality, Hayes 519. CHIRIQUI: vicinity of San Felix, eastern Chiriqui, alt. 0-120 m., Pittier 5143. CANAL ZONE: valley of Masambi, on road to Las Cascadas Plantation, alt. 20-100 m., Pittier 2593; Las Cascadas Plantation, near Summit, Standley 29652; Dodge & Hunter 8657; near Rio Medio, Miller 1719, 1743; Chico Trail, Rio Indio, Steyermark & Allen 17460; near Salamanca Hydrographic Station on the gorge of the Rio Pequeni, 70-80 m. alt., Dodge, Steyermark & Allen 16970; near Madden Dam and along Azote Caballo Road near Alahuela, alt. 90-100 m., Dodge 16588; Barro Colorado Island, Kenoyer 302. COLÓN: forests around Porto Bello, alt. 5-100 m., Pittier 2448.

382. *PEPEROMIA GLABELLA* var. *nervulosa* (C.DC.) Yuncker, comb. nov.

Micropiper melanostigma Miq. Comm. Phyt. 51. 1840.
Peperomia melanostigma Miq. Syst. Pip. 90. 1843.
Peperomia melanostigma var. *nervulosa* C.DC. in DC. Prodr. 16¹:409. 1869.
Peperomia glabella var. *melanostigma* Dahlst. in Kgl. Sv. Vet.-Akad. Handl. 33²:122. 1900.
Peperomia conjungens Trel. in Contr. U. S. Nat. Herb. 26:45. 1927.

Plants mostly larger than in the typical form; leaves lanceolate or elliptic-lanceolate, apex acute to sharp-acuminate, base acute to cuneate, 1-3 cm. wide \times 3-8 cm. long.

Found with the species.

CANAL ZONE: Las Cascadas Plantation, near Summit, Standley 25730; hills north of Frijoles, Standley 27411; Barro Colorado Island, Standley 31343; near Salamanca Hydrographic Station on the gorge of the Rio Pequeni, alt. 70-80 m., Dodge, Steyermark & Allen 16982a.

The densely black-dotted plants, ciliate petioles with decurrent subnodal ciliate lines, and leaf shape characterize this species. From *P. flagellispica* and *P. percuneata* it is to be distinguished chiefly because of the shape of the leaves.

39. *PEPEROMIA FLAGELLISPICA* Trel. in Field Mus. Nat. Hist. Bot. Ser. 18:314. 1937.

A moderate-sized, subrepent, conspicuously black-dotted (the dots are comparatively small), epiphytic herb; stem about 2 mm. thick, ascending to 10 cm. or more, sparsely pilose, especially near the nodes, internodes 1.5-4 cm. long; leaves alternate, elliptic-ob lanceolate, apex gradually sharp-acuminate, base cuneate, loosely pilose on both sides, bristly hairy at the apex, 1.5-2 cm. wide \times 4-6 cm. long, palmately 5-nerved, the innermost pair of lateral nerves confluent with the midrib near the base, drying firm, subopaque; petiole 5-10 mm. long, ciliate, clasping-decurrent; spikes terminal and axillary, solitary or commonly paired on a short stalk, 1 mm. thick \times 12-16 cm. long, rather loosely flowered; peduncle 1-1.5 cm. long, glabrous; bracts round-peltate, black-dotted; fruit ovoid, about 0.8 mm. long, apex obliquely rather acutely pointed, stigma subapical.

Changuinola Valley, Bocas del Toro.

BOCAS DEL TORO: Farm 1, Changuinola Valley, *Dunlap* 453.

This species resembles *P. glabella* in its dark dotting and ciliate petioles but differs because of the leaf shape and pubescence, and spike characters.

40. *PEPEROMIA PERCUNEATA* Trel. in Contr. U. S. Nat. Herb. 26:46. 1927.

A moderately small, stoloniferous, black-dotted herb; stem 1-2 mm. thick when dry, rooting at the nodes, fertile branches ascending to 5-10 cm., more or less ciliate below the petiole margins, internodes 2-4 cm. long; leaves alternate, rhombic- or elliptic-ob lanceolate, apex acuminate, base cuneate, glabrous on both sides, ciliolate toward the apex, 8-15 mm. wide \times 3-5.5 cm. long, palmately 5-nerved, the lateral nerves obscure, drying firm, subopaque; petiole 3-5 mm. long, channelled above, margins ciliate, clasping-decurrent; spikes terminal and axillary, moderately flowered, 1 mm. thick \times 10 cm. long; peduncle 5-10 mm. long, glabrous; bracts round-peltate, black-dotted; ovary ovoid, apex oblique, stigma subapical.

Panama.

CHIRIQUI: along Rio Dupí, near sea-level, *Pittier* 5224. COLÓN: along Río Fató, in forests or thickets, alt. 10-100 m., *Pittier* 3914.

This species resembles *P. glabella* to a considerable extent but differs primarily because of the leaf shape. It differs from *P. flagellispica*, which it also resembles somewhat, because of its glabrous leaves.

41. *PEPEROMIA DIRUPTORUM* Trel. in Ann. Mo. Bot. Gard. 27:302. 1940.

A moderately small, glabrous, rhizomatous herb; stem 2 mm. thick when dry, branches ascending to 15 cm. or more, internodes 1-2 cm. long; leaves alternate, elliptic-ob lanceolate or subobovate, lower leaves subspatulate, apex acute or lower leaves very obtuse, base acute to cuneate, 1-2.5 \times 2-5 cm., 5-nerved with the innermost lateral nerves coalescing with the midrib within the lowermost 5-10 mm., bristly-hairy at the apex, drying moderately thin, subtranslucent, paler

beneath; petioles 5–8 mm. long, channelled above and narrowly winged by the decurrent blade, clasping-decurrent; spikes terminal, as yet immature, 2 mm. thick \times 3.5 cm. long, densely flowered; peduncle 1 cm. long; bracts round-peltate, glandular-dotted; ovary ovoid, apex oblique, stigma subapical.

Bajo Mona, Chiriquí.

CHIRIQUI: Bajo Mona, mouth of Quebrada Chiquero, along Rio Caldera, alt. 1500–2000 m., *Woodson, Allen & Seibert 1023*.

42. *PEPEROMIA PASCUICOLA* C.DC. in *Candollea* 1:352. 1923.

Peperomia novae-belvetiae Trel. in *Ann. Mo. Bot. Gard.* 27:304. 1940.
Peperomia rivi-vetus Trel. loc. cit. 1940.

A medium-sized, assurgent, glabrous herb; stem 3–4 mm. thick when dry, ascending to 20 cm., internodes mostly 1–3 cm. long; leaves alternate, broadly lance-elliptic or subobovate, 2–3.5 cm. wide \times 4–8 cm. long, apex rather abruptly acuminate, or occasional leaves obtuse, base acute, palmately 5-nerved, rather densely venulose by transmitted light, the nervules anastomosing, apex somewhat bristly-hairy, drying thin, translucent; petiole mostly about 1 cm. long, clasping-decurrent; spikes axillary and terminal, 2 mm. thick \times 6–9 cm. long, rather closely flowered; peduncle about as long as the petiole; bracts round-peltate; fruit about 0.8 mm. long, subglobose or somewhat flattened laterally, at first subimmersed, eventually exserted on pseudopedicels, apex obliquely short-rostellate, stigma subapical.

Southwestern Panama.

CHIRIQUI: valley of the upper Rio Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m., *Seibert 136*; vicinity of "New Switzerland," central valley of Rio Chiriquí Viejo, alt. 1800–2000 m., *Allen 1360, 1417*; El Boquete, alt. 1400–1650 m., *Killip 3547*; alt. 1000–1300 m., *Pittier 2913*.

43. *PEPEROMIA ELATA* C.DC. in *Candollea* 1:355. 1923.

A rather large, divaricately branching, tree-like, glabrous herb; stem "about 1 m. tall, green, conspicuously mottled with red," internodes 6 cm. or more long below, reduced upward; leaves alternate, lance-elliptic and rather long-acuminate, or lower leaves round-elliptic and abruptly and bluntly short-acuminate, base acute, 2–3 cm. wide \times 6–7 cm. long, or lower leaves 4–5 \times 6–7 cm., ciliate toward the apex, palmately 5- or faintly 7-nerved, the nerves prominent, drying thin, translucent, rather densely glandular-dotted, "very dark, lustrous and satiny above; below very pale, non-lustrous and conspicuously ribbed" when living; petiole mostly 5–10 mm. long, grooved above, clasping-decurrent; spikes axillary and terminal, "dark red" when living, 2 mm. thick \times 6–10 cm. long, moderately flowered; peduncle about 1 cm. long; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical; fruit not matured.

Above El Boquete, Chiriquí.

CHIRIQUI: humid forest along the upper Caldera River, near "Camp 1", Holcomb's Trail, above El Boquete, alt. 1450–1650 m., *Maxon 5582*.

This species is similar to *P. portobellensis* in many respects, from which it differs, however, because of its axillary rather than sympodial spikes.

44. *PEPEROMIA LEUCOSTICTA* Trel. in Contr. U. S. Nat. Herb. 26:46. 1927.

Peperomia appellator Trel. in Ann. Mo. Bot. Gard. 27:300. 1940.

Peperomia simulatio Trel. loc. cit. 305. 1940.

A rather small, repent-assurgent, glabrous, mountain herb; stem about 2 mm. thick, fertile branches ascending to 10–15 cm., internodes 1–2 cm. long; leaves alternate, subrhombically ovate or elliptic-obovate, apex abruptly acute, base acute, 1–2 cm. wide \times 2–3.5 cm. long, palmately 3- or faintly 5-nerved, bristly-ciliolate toward the apex, glandular-dotted, drying subcoriaceous, translucent; petioles 5–10 mm. long, clasping-decurrent; spikes terminal and axillary, 2 mm. thick \times 3–5 cm. long, rather closely flowered; peduncle about 1 cm. long; bracts round-peltate; fruit globose, about 0.8 mm. long, apex oblique, stigma subapical.

Panama.

PANAMA: without location, Hayes 811. CHIRIQUÍ: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m., June 28–July 2, 1938, Woodson, Allen & Seibert 816, 895.

This species very closely resembles *P. psiloclada* of Costa Rica.

45. *PEPEROMIA PARIETARIAEFOLIA* Trel. in Contr. U. S. Nat. Herb. 26:45. 1927.

A rather large, divaricately branched, glabrous herb; stem about 5 mm. thick below when dry, slender above, erect or ascending, up to 50 cm. or more tall, internodes 1 cm. long above to 5 cm. long below; leaves alternate, lance-elliptic, 1.2–2.5 cm. wide \times 4–6 cm. long, apex acuminate, base acute, palmately rather conspicuously 5-nerved, the innermost pair of lateral nerves slightly confluent with the midrib near the base, ciliolate toward the apex, drying thin, subopaque, densely glandular-dotted beneath; petiole about 5 mm. long, clasping-decurrent; spikes axillary, 1 mm. thick \times 5–6 cm. long, loosely to moderately flowered; peduncle 1 cm. long; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical.

Southwestern Panama.

CHIRIQUÍ: Boquete District, Bajo Chorro, alt. 1800 m., Davidson 346; valley of Rio Caldera, from El Boquete to the Cordillera, alt. 1400–1600 m., Killip 3520.

46. *PEPEROMIA OBSCURIFOLIA* C.DC. in Candollea 1:357. 1923.

Peperomia fatoana C.DC. loc. cit. 1923.

Peperomia obscurifolia var. *fatoana* Trel. in Contr. U. S. Nat. Herb. 26:47. 1927.

Peperomia obscurifolia var. *minor* Trel. loc. cit. 1927.

Peperomia Baileyae Trel. in Contr. Arn. Arb. 5:53. 1933.

A rather small, stoloniferous herb, growing on trees, logs, and rocks; stem 1–2 mm. thick, ascending to 10–15 cm., subappressed-villous, rooting at the nodes, internodes 1–3 cm. long below, reduced upward; leaves alternate, lance-elliptic or subob lanceolate, apex acute, base acute to cuneate, 1–1.5 cm. wide \times 2–4 cm. long, or occasional leaves up to 2 \times 5.5 cm., 5-nerved, the innermost pair of lateral nerves commonly coalescing with the midrib near the base, glabrous above or rarely

sparsely hairy along the nerves near the base, the nerves beneath usually sparsely hairy, ciliolate toward the apex, drying rather firm, subtranslucent, usually darker above, lighter beneath; petioles mostly 3-5 mm. long, channelled above, villous or with ciliate margins; spikes axillary and terminal, 1-1.5 mm. thick \times 6-8 cm. long, rather closely flowered; peduncles 5-10 mm. long, soft-hairy; bracts round-peltate; fruit globose, about 0.5 mm. long, eventually on pseudopedicels, apex oblique, stigma subapical.

Central Panama.

COCLÉ: mountains beyond La Pintada, alt. 400-600 m., *Hunter & Allen* 565; El Valle de Antón and vicinity, alt. 500-700 m., *Seibert* 453. CANAL ZONE: Agua Clara, Trinidad River, alt. 10-40 m., *Pittier* 3982, 3983; between Matachín and Las Cascadas, *Cowell* 336; near Summit, Las Cascadas Plantation, *Standley* 25726; Barro Colorado Island, Gatún Lake, *Standley* 31333; *Bailey & Bailey* 84. COLÓN: Río Fató, alt. 10-1000 m., *Pittier* 3902.

There is considerable variation in the size of the leaves on the different specimens cited here but no more than is to be noted on certain individual specimens. There appear to be no other obvious characters by which the varieties recognized by Trelease can be maintained.

47. *PEPEROMIA Davidsonii* Yuncker, sp. nov.

Herba videtur statura moderata assurgens terrestris; caule superne dissite crispe-villoso, inferne glabrescente; foliis late ellipticis vel elliptico-obovatis, apice obtusis, basi abrupte acutis, palmatim 3-nerviis, utrinque dissite crispe-villosis, apicem versus ciliolatis; petiolo 5-15 mm. longo, crispe-villoso amplectenti-decurrente; spicis terminalibus axillaribus; pedunculo 5-10 mm. longo, dissite crispe-villoso; ovario ovoideo, apice obliqua, stigmate subapicali.

A medium-sized, assurgent, terrestrial herb; stem 4 mm. thick when dry, ascending to 30 cm., sparsely crisp-villous above, glabrescent downward, internodes 1-2 cm. long; leaves alternate, broadly elliptic or elliptic-obovate, slightly constricted toward the obtuse apex, base abruptly acute, palmately 3-nerved, the midrib and lateral nerves with numerous slender, anastomosing branches, sparsely crisp-villous on both sides, at least along the nerves toward the base, 2-3.5 cm. wide \times 3-6 cm. long, ciliolate toward the apex, drying membranous, translucent, fine glandular-dotted beneath; petioles 5-15 mm. long, grooved above, the groove crisp-villous, clasping-decurrent; spikes terminal and axillary, loosely flowered, 1 mm. thick \times 3 cm. long; peduncle 5-10 mm. long, sparsely crisp-villous; bracts round-peltate; ovary ovoid, apex oblique, stigma subapical; fruit not matured.

Known only from the type locality.

CHIRIQUI: Volcán de Chiriquí, alt. 2850 m., July 18, 1938, *M. E. Davidson* 1029 (U. S. Nat. Herb., TYPE).

The broadly elliptic or subobovate, obtuse, 3-nerved leaves, and crisp pubescence distinguish this species from *P. pascuicola* which it resembles to a considerable extent.

IV. KEY TO SPECIES WITH CYLINDRICAL OR ELLIPSOIDAL, BASALLY ATTACHED FRUIT, AND WITH APEX OBLIQUELY SCUTELLIFORM AND STIGMA MORE OR LESS CENTRAL, OR SLENDERLY ROSTRATE, AND STIGMA ANTERIOR NEAR THE BASE OF THE BEAK.

(Subgenus *YNCHOPHORUM* (Miq.) Dahlst. in part).

- a. Fruit mostly more or less cylindrical, sometimes thicker downward, apex obliquely scutelliform.
 - b. Leaves subpetiolate..... 61. *P. CORDULATA*
 - bb. Leaves not at all peltate.
 - c. Plants conspicuously black-dotted..... 38. *P. GLABELLA*
 - cc. Plants not black-dotted, glands, if present, not black.
 - d. Petioles mostly less than 5 mm. long, stout.
 - e. Stems and leaves glabrous..... 48. *P. PORTOBELLENIS*
 - ee. Stems and/or petioles villous when young and/or about the nodes, leaves mostly drying more or less coriaceous and opaque.. 49. *P. CAUDULILIMBA*
 - dd. Petioles mostly 5-20 mm. long, not markedly stout, leaves mostly drying membranous and translucent.
 - e. Petioles and/or young stems, if hairy, minutely hirtellous..... 50. *P. OBLONGIBACCA*
 - ee. Petioles somewhat villous-ciliate, stems glabrous or the nodes sparsely villous..... 50c. *P. OBLONGIBACCA* var. *SUBVILLOSA*
 - aa. Fruit mostly ellipsoidal, apex more or less slenderly rostrate, stigma anterior.
 - b. Leaves palmately nerved, or essentially so.
 - c. Leaves mostly 1-2 cm. long, as wide as long, apex scarcely protracted..... 51. *P. SERPENS*
 - cc. Leaves mostly larger.
 - d. Spikes on axillary stalks..... 52. *P. UROCARPOIDES*
 - dd. Spikes on leaf-opposed stalks.
 - e. Leaves narrowly peltate, strongly red-glandular..... 65. *P. PERGLANDULOSA*
 - ee. Leaves not peltate nor strongly red-glandular..... 53. *P. DIGITINERVIA*
 - bb. Leaves pinnately-nerved.
 - c. Leaves elliptic-ovate, base rounded..... 54. *P. DISTACHYA*
 - cc. Leaves not ovate, base mostly acute to cuneate.
 - d. Leaves puberulent above, scarcely more than 5 cm. long..... 55. *P. MACHAERODONTA*
 - dd. Leaves glabrous, or obscurely hirtellous along the midrib beneath, mostly larger.
 - e. Peduncle minutely hirtellous.
 - f. Bracts strongly imbricated..... 56b. *P. OBTUSIFOLIA* var. *LONGIBRACTEATA*
 - ff. Bracts scarcely imbricated, mostly 0.3-0.4 mm. wide; fruit beak slender, terete, strongly hooked..... 56. *P. OBTUSIFOLIA*
 - ee. Peduncle glabrous, bracts mostly 0.5 mm. wide; fruit beak gradually narrowed from a wide base, not strongly hooked..... 57. *P. MAGNOLIAEFOLIA*

48. *PEPEROMIA PORTOBELLENIS* Beurl. Sv. Vet.-Akad. Handl. 1854:147. 1856.

A glabrous, subsimple herb, rooting from the nodes; leaves alternate, oblong, apex acuminate, base obtusish, 1-2.5 cm. wide \times 5-7.5 cm. long, obscurely 5-nerved; petiole very short; spikes opposite the leaves, pendent, subulate-filiform, 10 cm. long; fruit oblong, granular, apex obliquely scutelliform, stigma central on the scutellum.

Porto Bello, Colón.

COLÓN: Porto Bello, Bilberg.

This species, the type of which has not been examined, appears to be very closely related to *P. caudulilimba*. As described, it appears to differ in its glabrous plants and 5-nerved leaves. However, some leaves of *P. caudulilimba* may be 5-

nerved with an obscure outer pair of lateral nerves, and the stems and leaves are sometimes nearly glabrous. It is possible that further study may show that this and *P. caudulilimba* are different forms of the same species.

49. *PEPEROMIA CAUDULILIMBA* C.DC. in Ann. Conserv. & Jard. Bot. Genève 21:269. 1920.

Peperomia gatunensis C.DC. in Candollea 1:363. 1923.

Peperomia piperorum Trel. in Contr. U. S. Nat. Herb. 26:49. 1927.

Peperomia caudulilimba var. *cryptopoda* Trel. loc. cit. 1927.

?*Peperomia caudulilimba* var. *longependula* C.DC. loc. cit. 1920.

A moderate-sized, often long-pendent, arboricolous herb; stem 2-3 mm. thick when dry, rooting from the lower nodes, branches often long and pendent, more or less villous, usually at least about the nodes, internodes up to 7-8 cm. long below, reduced upward; leaves alternate, lanceolate or lance-elliptic, apex narrowly sharp-acuminate, base somewhat rounded, obtuse or subacute, mostly 1-2.5 cm. wide \times 4-8 cm. long, occasionally up to 4 \times 11 cm., glabrous on both sides, or rarely sparsely hairy beneath, pinnately nerved from below the middle with two pair of nerves approximated near the base and a third pair toward the middle, usually more or less ciliate, mostly somewhat yellow glandular-dotted beneath, drying coriaceous, opaque; petiole less than 5 mm. long, stout, commonly ciliate; spikes solitary or often paired on bracted stalks 5-10 mm. long, closely flowered, 1-2 mm. thick \times 8-12 cm. long; peduncle glabrous or sparsely hairy, 1-1.5 cm. long; bracts round-peltate; fruit reddish, cylindrical, about 2 mm. long, apex obliquely truncate, scutelliform, stigma central on the scutellum.

Panama.

BOCAS DEL TORO: Old Bank Island, vicinity of Chiriquí Lagoon, von Wedel 1872; Water Valley, von Wedel 1890; Farm 6, Changuinola Valley, Dunlap 486. COCLÉ: above Penonomé, Williams 366. CANAL ZONE: Cowell 23919; railroad relocation between Gorgona and Gatún, alt. 10-50 m., Pittier 2280; Río Agua Salud, near Frijoles, Piper 6035; vicinity of Fort Sherman, Standley 31118; forest along the Río Indio de Gatún, near sea-level, Pittier 2788; Maxon 4818, 4864; near Río Medio, Miller 1735 near Salamanca Hydrographic Station on the gorge of the Río Pequeni, alt. 70-80 m., Dodge, Steyermark & Allen 16982; Barro Colorado Island, Gatún Lake, Standley 31321, 31356, 41167. DARIÉN: Boca de Panarandó, on Sambú River, alt. 20 m., Pittier 5571.

49a. *PEPEROMIA CAUDULILIMBA* var. *cylindribacca* (C.DC.) Yuncker, comb. nov.

Peperomia cylindribacca C.DC. in Candollea 1:370. 1923.

Leaves 4-5 cm. wide \times 9-11 cm. long, densely ciliate; fruit 2.5 mm. long, scutellum acute.

Known only from the type locality.

CHIRIQUI: vicinity of San Felix, alt. 0-120 m., Dec. 1911, Pittier 5273 (U. S. Nat. Herb., TYPE).

This species is one of a series, including *P. macrostachya* of South America, which appears to be very closely related and may, indeed, represent only variations of a single polymorphic species. Careful field observations, including mass collec-

tions, are needed to interpret adequately the various forms which have been described. It is very closely related to *P. oblongibacca* from which it differs because of its mostly shorter petioles, more coriaceous leaves, and with villous rather than hirtellous type of pubescence.

50. *PEPEROMIA OBLONGIBACCA* C.DC. in *Candollea* 1:288. 1923.

A moderate-sized, epiphytic herb; stem 2-3 mm. thick, branches somewhat pendulous, glabrous or obscurely and minutely hirtellous, internodes mostly 2-3 cm. long; leaves alternate, elliptic, lance-elliptic or subob lanceolate, apex sharply long-acuminate, base acute to cuneate, glabrous on both sides, loosely ciliate, 5- or obscurely 7-plinerved from below the middle, glandular-dotted beneath, drying thin, translucent; petiole slender, up to 2 cm. long below, reduced upward; spikes 1, 2, or sometimes 3 on short, bracted, sympodial branches, 1-1.5 mm. thick \times 15-20 cm. or more long, closely flowered, peduncle 1 cm. long, obscurely hirtellous glabrescent; bracts comparatively large, round-peltate; fruit subcylindrical, 2-3 mm. long, apex obliquely scutelliform, stigma central on the scutellum.

Río Fató, Colón.

COLÓN: along Río Fató, in forests or thickets, alt. 10-100 m., Pittier 3891.

KEY TO THE VARIETIES OF *P. OBLONGIBACCA*

| | |
|--|--------------------------|
| a. Minutely puberulent on young growth, or glabrous; petioles not ciliate. | |
| b. Leaves 6-7 cm. long. | |
| c. Leaf base subcuneate; stems obscurely hirtellous. | <i>P. OBLONGIBACCA</i> |
| cc. Leaf base acute; stems puberulent. | var. <i>MARRAGANTINA</i> |
| bb. Leaves 10-12 cm. long. | var. <i>MACROPHYLLA</i> |
| aa. Nodes more or less sparsely villous; petioles ciliate. | var. <i>SUBVILLOSA</i> |



Fig. 19. *Peperomia oblongifolia*
var. *macrophylla*

50a. *PEPEROMIA OBLONGIBACCA* var. *marragantina* (C.DC.) Yuncker, comb. nov.

Peperomia candulilimba var. *marragantina*
C.DC. in *Candollea* 1:382. 1923, as *marr-*
regantina, name only.

Young growth velvety-puberulent;
leaves lance-ovate.

Known only from the type locality.

PANAMÁ: Marraganti, April 6, 1903,
Williams 694 (U. S. Nat. Herb., TYPE).

50b. *PEPEROMIA OBLONGIBACCA* var. *macrophylla* Yuncker, var. nov.

Caule juvenili minute hirtello vel
glabratu; foliis 7-plinerviis.

Young growth obscurely and minutely
hirtellous or glabrous; leaves 3.5-5 cm.
wide \times 12-14 cm. long, 7-plinerved.

Known only from the type locality.

CANAL ZONE: drowned forest near Vigia and San Juan on Río Pequeni, alt. 66 m., Nov. 26, 1934, Dodge, Steyermark & Allen 16522 (Herb. Missouri Bot. Gard., TYPE).

50c. *PEPEROMIA OBLONGIBACCA* var. *subvillosa* Yuncker, var. nov.

Caulibus ad nodos dissite villosis; foliis ovatis, 5-7-plinerviis; petiolo ciliato.

Nodes more or less sparsely villous; leaves ovate, 5- to 7-plinerved; petiole commonly ciliate.

Known only from the type locality.

CANAL ZONE: near Rio Medio, Feb. 11, 1937, Miller 1740 (U. S. Nat. Herb., TYPE).

The plants included here are all obviously rather closely related but differ in the characters as described. It is not believed that they represent individual species and there may be some question regarding their status even as varieties.

51. *PEPEROMIA SERPENS* (Sw.) Loud. Hort. Brit. 13. 1830.

Piper serpens Sw. Prodr. Veg. Ind. Occ. 16. 1788.

Peperomia scandens Ruiz & Pav. Fl. Peruv. & Chil. 1:32, pl. 51, 5.b. 1798.

Piper scandens Vahl, Enum. 1:346. 1804, not Sw. 1788.

Piper bracteatum Thomps. in Trans. Linn. Soc. 9:203, pl. 21. 1808.

Peperomia repens H.B.K. Nov. Gen. & Sp. 1:65. 1815.

Peperomia reniformis Hook. Exot. Fl. 3:pl. 164. 1827.

Piper Guildingianum Spreng. Syst. Veg. 4. Cur. Post. 21. 1827.

Peperomia pulicaris Opiz in Presl, Reliq. Haenk. 1:162, pl. 30. 1830.

Peperomia myosurus hb. Willd. in A. Dietr. Sp. Pl. 1:159. 1831.

Peperomia Guildingiana A. Dietr. loc. cit. 162. 1831.

Piper myosurus hb. Willd. in D. Dietr. Syn. Pl. 1:110. 1839.

Verbuellia serpens Miq. Syst. Pip. 49. 1843.

Acrocarpidium pulicare Miq. loc. cit. 57. 1843.

Acrocarpidium repens Miq. loc. cit. 59. 1843.

Acrocarpidium scandens Miq. loc. cit. 1843.

Piper herbaceum Miq. loc. cit. 1843.

Acrocarpidium Guildingianum Miq. in Hook. Lond. Jour. Bot. 4:412. 1845.

?*Peperomia reptans* C.DC. in Jour. Bot. 4:143. 1866.

?*Peperomia scandens* var. *fertilior* C.DC. in DC. Prodr. 16¹:434. 1869.

A comparatively small, creeping or scandent herb; stem slender, crisp-pubescent; leaves alternate, round-subdeltoid, mostly 1-2 cm. wide or occasionally up to 3 cm., apex acute or obtuse, base truncate-cordulate, palmately 3- to 5-nerved, drying rather membranous and thin, more or less crisp-pubescent on both sides; petiole 5-30 mm. long, crisp-pubescent; spikes axillary and sympodially terminal, up to 3 cm. long; peduncle 1- or rarely 2-bracted, usually about as long as the spike, crisp-pubescent; floral bracts round-peltate; fruit about 1 mm. long, ellipsoidal, stigma at the base of the slender, pointed beak.

West Indies, and on the mainland southward from Panama to Brazil and Peru.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, von Wedel 1034. CANAL ZONE: Río Indio de Gatún, near sea-level, Maxon 4857.

52. *PEPEROMIA UROCARPOIDES* C.DC. in Candollea 1:362. 1923.

A rather small, repent, crisp-hairy herb; stem 1-2 mm. thick, rooting from the nodes, internodes mostly 2-3 cm. long; leaves alternate, ovate, apex gradually bluntly pointed, base rounded, obtuse, cordulate, or acutish at the petiole, 1.5-3

cm. wide \times 2-3.5 cm. long, crisp-pubescent on both sides, ciliate, palmately 5-nerved, the nerves branched upward, more or less glandular-dotted, drying subcoriaceous, subopaque; petiole 1-2 cm. long, crisp-pubescent; spikes axillary or terminal, 1 mm. thick \times 3 cm. long; peduncle crisp-pubescent, 1 cm. or more long, bracteate at about the middle; floral bracts round-peltate; fruit oblong, obliquely slender-mucronate, stigma near the base of the beak.

Panama.

COCLÉ: mountains beyond La Pintada, alt. 400-600 m., Hunter & Allen 571. DARIÉN: Cerro de Garagará, Sambú basin, southern Darién, alt. 500-974 m., Pittier 5670.

This species differs from *P. urocarpa* in the shape of the 5-nerved leaves, etc.

53. PEPPEROMIA DIGITINERVIA Trel. in Ann. Mo. Bot. Gard. 27:302. 1940.

A repent, epiphytic herb; stem 1-2 mm. thick, rooting at the nodes, rather densely crisp-puberulent, internodes 2-4 cm. or more long; leaves alternate, ovate, apex acute, base subtruncate, cordulate or acute at the petiole, 2-3 cm. wide \times 2.5-4 cm. long, subpalmately 5-nerved, the innermost pair of lateral nerves coalescing with the midrib within the lowermost 2-3 mm., sparsely pubescent above, paler and crisp-puberulent beneath, at least along the nerves, ciliate, drying coriaceous, subopaque; petiole 1-3.5 cm. long, pubescent glabrescent, channelled above; spikes leaf-opposed, 2 mm. thick \times 3.5 cm. long, densely flowered; peduncle 2 cm. long, crisp-puberulent, 1-bracteate near the middle; floral bracts round-peltate; fruit ellipsoidal, about 0.8 mm. long, rostrate, stigma anterior at the base of the beak.

El Valle, Coclé.

COCLÉ: vicinity of El Valle, alt. 600-1000 m., Allen 1221.

This species resembles *P. cubensis* to some extent but differs because of the pubescence, smaller leaves, etc.

54. PEPPEROMIA DISTACHYA (L.) A. Dietr. Sp. Pl. 1:156. 1831.

Piper distachyon L. Sp. Pl. 1:30. 1753.

Pepperomia producta Griseb. Fl. Br. W. Ind. 166. 1864.

Pepperomia Bakerii C.D.C. in Urb. Symb. Ant. 5:296. 1907.

A sparsely hairy or glabrate, creeping or sometimes scandent herb; stems 2-3 mm. thick, rooting at the nodes; leaves alternate, elliptic-ovate, 4-5 cm. wide \times 7-8.5 cm. long, apex acuminate, typically rounded at the base and sometimes cordulate or barely subpeltate, drying rather thin and dull, sparsely hairy beneath when young, or glabrous on both sides, ciliolate towards the apex, 9-plinerved with the nerves coalescing below the middle; petiole 3-5 or sometimes even 9 cm. long, glabrous or somewhat ciliate; spikes 3-5 cm. or more long, mostly paired at the ends of terminal or axillary stalks 3-4 cm. long; peduncle scarcely 2 cm. long; bracts round-peltate; fruit ellipsoidal, rostrate, stigma at the base of the beak.

Common in the West Indies. Apparently rare in Panama. Also reported from the Guianas and Ecuador.

BOCAS DEL TORO: Fish Creek, vicinity of Chiriquí Lagoon, *von Wedel* 2193. COCLÉ: mountains beyond La Pintada, alt. 400-600 m., *Hunter & Allen* 573. PANAMÁ: summit of Cerro Campaña, alt. 800-1000 m., *Allen* 2224.

55. *PEPEROMIA MACHAERODONTA* Trel. in Contr. U. S. Nat. Herb. 26:47. 1927.

A rather small, suberect, epiphytic herb; stem 3 mm. thick, simple, ascending to 10 cm. or more, glabrous, drying wrinkled, yellow-glossy, internodes 1-2 cm. long; leaves alternate, elliptic, round-elliptic, or subobovate, apex abruptly short-acuminate, base acute or subrounded, glabrescent beneath, crisp-puberulent above, especially along the nerves, pinnately nerved to above the middle, the nerves about 4 on each side, 2-3 cm. wide \times 3-5.5 cm. long, drying coriaceous, opaque, somewhat glossy-wrinkled, especially near the margin, with scattered glandular-dots; petiole 5-10 mm. long, glabrous, yellow-glossy, channelled above; spikes terminal, 2 mm. thick \times 6-8 cm. long, rather closely flowered; peduncle 1.5-2.5 cm. long, glabrous; bracts round-peltate, pale-glandular-dotted; fruit ellipsoidal, about 1 mm. long, rostrate, stigma anterior near the base of the pale, subterete, erect, slightly curved, equilong beak.

Valley of the Río Piarnasta, east of El Boquete, Chiriquí.

CHIRIQUI: valley of Río Piarnasta, about 5 miles east of El Boquete, alt. 1525-1600 m., *Killip* 3538.

The rather small plants, puberulent upper leaf surface, small, pinnately nerved leaves, and type of fruit characterize this species.

56. *PEPEROMIA OBTUSIFOLIA* (L.) A. Dietr. Sp. Pl. 1:154. 1831.

Piper obtusifolium L. Sp. Pl. 30. 1753.

?*Piper cuneifolium* Jacq. Collect. 4:127, pl. 214. 1788.

Piper bumble Mill. Gard. Dict. no. 4, ex Poir. in Lam. Encycl. Meth. 5:473. 1804, fide C.D.C. in Urb. Symb. Ant. 3:254. 1902

Piper Milleri Roem. & Schult. Syst. Veg. 1:337. 1817, fide C.D.C. loc. cit. 1902.

Peperomia hemionitidifolia Ham. Prodri. Pl. Ind. Occ. 2. 1825, fide C.D.C. in Urb. Symb. Ant. 3:254. 1902.

?*Peperomia cuneifolia* A. Dietr. Sp. Pl. 1:146. 1831.

Peperomia commutata Trel. in Fedde Rep. Sp. Nov. 23:29. 1926, in part.

Peperomia bayatana Trel. loc. cit. 30. 1926.

Peperomia daquiriana Trel. loc. cit. 1926.

Peperomia Lunana Trel. loc. cit. 1926.

Peperomia Earlei Trel. loc. cit. 31. 1926.

Peperomia dodecatheontophylla Trel. in Contr. U. S. Nat. Herb. 26:48. 1927.

Peperomia Antonii var. *reducta* Trel. in Ann. Mo. Bot. Gard. 27:299. 1940.

A fleshy, stoloniferous-assurgent, terrestrial or epiphytic herb, glabrous except for the peduncle which is minutely hirtellous as is also sometimes the lower leaf-surface; stem up to 5 mm. thick when dry, ascending to 15 cm. or more from the prostrate, rooting base, internodes mostly 2-3 cm. long; leaves alternate, elliptic-obovate, 3-8 cm. wide \times 5-20 cm. long, occasional specimens with smaller leaves, but commonly about 4-6 \times 8-12 cm., apex rounded, obtuse, sometimes slightly emarginate, base cuneate, 7- to 11-plinerved from below the middle, the midrib branched upward, drying more or less coriaceous, opaque; petiole mostly 1.5-4

cm. long, or occasionally somewhat longer, more or less winged by the decurrent blade; spikes 2–4 mm thick \times 5–15 cm. long, densely flowered, solitary or paired on a 1-bracted, terminal, leaf-opposed, or occasionally axillary, usually minutely hirtellous stalk 3–5 cm. or more long; floral bracts 0.3–0.4 mm. wide, round-peltate; fruit ellipsoidal, about 1.25 mm. long including the slender, erect, terminally hooked beak, stigma anterior at the base of the beak.

General in the West Indies and on the mainland from Mexico through Central America and northern South America.

COCLÉ: vicinity of El Valle, alt. 600–1000 m., Allen 1222. CANAL ZONE: along Río Indio de Gatún, Pittier 2800; Summit, Lindsay 402.

56a. *PEPEROMIA OBTUSIFOLIA* var. *EMARGINATA* (Ruiz & Pav.) Dahlst. in Kgl. Sv. Vet.-Akad. Handl. 33²:66. 1900.

Peperomia emarginata Ruiz & Pav. Fl. Peruv. & Chil. 1:33, pl. 49, f.a. 1798.
Piper emarginatum Vahl, Enum. Pl. 1:339. 1804.

Stems short; leaves oblong-elliptic-obovate, apex somewhat narrowed and rounded, emarginate, mostly 2 to 3 times longer than wide; spikes 2–3 mm. thick, up to 8–15 cm. long, single, or more commonly divergently paired on a common, terminal, or leaf-opposed stalk 1–4 cm. long, or occasionally subpaniculately 3-spiked; fruit about 1 mm. long.

Found with the species.

VERAGUAS: vicinity of Santa Fé, forested slopes of Cerro Tute, alt. 900 m., Allen 4334. CANAL ZONE: near Salamanca Hydrographic Station on the gorge of the Río Pequeni, 70–80 m., Dodge, Steyermark & Allen 16525, 16525b; near Rio Medio, Miller 1736.

56b. *PEPEROMIA OBTUSIFOLIA* var. *longibracteata* Yuncker, var. nov.

Foliis ellipticis; spicis 3 in panicula elongata laxa axillari bracteata dispositis, bracteis linear-lanceolatis usque ad 3 cm. longis; pedunculo 2–4 cm. longo minute hirtello; ovario ellipsoideo rostrato.

Leaves elliptic, 4–5 cm. wide \times 10–12 cm. long; spikes 3 mm. thick \times 5 cm. or more long, in a 3-spicate, elongate, loosely paniculate, axillary inflorescence, the main stalk 8–10 cm. long, individual peduncles 2–4 cm. long, minutely hirtellous, in the axils of linear-lanceolate bracts up to 3 cm. long; floral bracts subquadangular-peltate, strongly imbricate in young spikes; ovary ellipsoidal, rostrate, stigma at the base of the beak; fruit not matured.

South-central Panama.

COCLÉ: region north of El Valle de Antón, alt. 1000 m., Sept. 27, 1946, Allen 3730 (Herb. Missouri Bot. Gard., TYPE); La Mesa, Aug. 31, 1941, Allen 2728.



Fig. 20. *Peperomia obtusifolia* var. *longibracteata*

This species exhibits great variation in the size and shape of the leaves and length of the spikes, sometimes on the same plant. It has not been possible to maintain as distinct the several species proposed by Trelease. The variability of the plants, readily observed in the field, leads one to conclude that only one species is represented. The hirtellous peduncle and commonly also the lower leaf surface, much smaller bracts, and more slender and strongly hooked beak of the fruit distinguish it from *P. magnoliaefolia*.

Variety *longibracteata* bears considerable resemblance to many specimens believed unquestionably to represent *P. obtusifolia*. The elongated 3-spicate, long-bracteate, paniculate inflorescence, and strongly imbricated floral bracts are rather strong differential characters. Additional collections may show that this variety merits specific status. In the meantime, however, it is given a rather questionable varietal status. The axillary inflorescence, etc. distinguishes it from *P. magnoliaefolia*, and the leaf shape and size, especially, from *P. Williamsii*.

57. *PEPEROMIA MAGNOLIAEFLORIA* (Jacq.) A. Dietr. Sp. Pl. 1:153. 1831.

Piper magnoliaefolium Jacq. Collect. 3:210. 1789.

Piper subrotundum Haw. Rev. Pl. Succ. 2. 1819.

Peperomia subrotunda A. Dietr. loc. cit. 154. 1831.

Peperomia amplexicaulis (Sw.) A. Dietr. var. *magnoliaefolia* (A. Dietr.) Griseb. Fl. Br. W. Ind. 176. 1859.

Peperomia euosma Trel. in Fedde Rep. Sp. Nov. 23:29. 1926.

Peperomia Antoni Trel. in Ann. Mo. Bot. Gard. 24:185. 1937.

Peperomia Antoni f. *fertilior* Trel. loc. cit. 27:299. 1940.

Peperomia Antoni f. *lutea* Trel. loc. cit. 300. 1940.

A moderately large, assurgent, glabrous, succulent herb; stem 3-5 mm. thick, rooting at the lower nodes, ascending to 25 cm. or more, internodes mostly 1-5 or 6 cm. long; leaves alternate, round, obovate-elliptic, or subspatulate, 3-8 cm. wide \times 6-15 cm. long, apex rounded, often emarginate, base cuneate or sometimes rather abruptly contracted, drying dull, coriaceous, opaque, 7- to 9-plinerved from near the base, the rather prominent midrib pinnately branched upward, the lateral nerves slender and obscure; petiole 1-3 cm. long, more or less winged by the decurrent blade; spikes 3 mm. thick and up to 15-18 cm. long, closely flowered, 1-2 or sometimes 3 on a terminal or leaf-opposed, bracted stalk 5-10 cm. long; peduncle 1.5-3 cm. long, glabrous or rarely obscurely hirtellous; floral bracts round-peltate, mostly about 0.5 mm. wide; fruit about 1.25 mm. long, ellipsoidal, rostrate, the beak gradually narrowed from a broad base, from one-fourth to as long as the fruit, sharp and more or less curved but usually not hooked at the apex; stigma at the base of the beak.

West Indies, Panama, and northern South America.

BOCAS DEL TORO: Careening Cay, Isla Colón, alt. 0-120 m., von Wedel 565. COCLÉ: El Valle de Antón and vicinity, alt. 500-700 m., Seibert 437; alt. 800-1000 m., Allen 760, 1160, collection labelled "lata" on the herbarium sheets; between Las Margaritas and El Valle, Woodson, Allen & Seibert 1298. CANAL ZONE: Experimental Gardens, Stanwood 402.

This species is closely related to *P. obtusifolia* from which it is to be distinguished, however, because of its glabrous peduncles and lower leaf surface, wider floral bracts, and with the fruit beak mostly stouter and ordinarily not hooked at the end.

58. **PEPEROMIA HISPIDULA** (Sw.) A. Dietr. Sp. Pl. 1:165. 1831.

Piper hispidulum Sw. Prod. Veg. Ind. Occ. 15. 1788.

Acrocarpidium hispidulum Miq. Syst. Pip. 54. 1843.

Acrocarpidium Sellovianum Miq. loc. cit. 55. 1843.

?*Peperomia tenera* Miq. in Mart. Fl. Brasil. 4¹:19, pl. 1, f. 1. 1852.

?*Peperomia pilinervia* C.DC. in Bull. Herb. Boiss. 6:509. 1898.

?*Peperomia hispidula* var. *Sellowiana* Dahlst. in Kgl. Sv. Vet.-Akad. Handl. 33²:14. 1900.

Peperomia perhispidula C.DC. in Engl. Bot. Jahrb. 40:257. 1908.

Peperomia hispidula var. *perhispidula* C.DC. in Candolles 1:335. 1923.

Peperomia Woodsonii Trel. in Ann. Mo. Bot. Gard. 27:305. 1940.

A rather small, assurgent, branched, spreading herb; stem 2-3 mm. thick below when dry, branches ascending to 20 cm. or more from the decumbent, rooting base, hispid at least at the nodes, the hairs rigid to rather flaccid, internodes variable in length; leaves alternate, ovate-orbicular or rhombic-ovate, 8-15 mm. in diameter, apex rounded, obtuse, base rounded or triangular, obtuse, loosely hispid above or glabrate, loosely hispid beneath at least along the nerves, palmately 5-nerved with the midrib strongly branched at about the middle, drying membranous and subpellucid; petiole commonly 5-15 mm. long, slender, hispid to glabrate, but usually with at least a few hairs near the blade; spikes leaf-opposed or terminal, slender, mostly 1-2 cm. long, loosely and alternately flowered; peduncle slender, 10-15 mm. long, hispid to glabrate; bracts round-peltate; fruit globose-ovoid, about 1 mm. long, covered with white, hispid hairs and on a pedicel up to 0.5 mm. long when mature, stigma apical on a conic style.

West Indies, Central America, and northern South America. Apparently infrequent in Panama.

CHIRIQUI: vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500-2000 m., *Woodson, Allen & Seibert* 933.

Dahlstedt included this species in the subgenus ACROCARPIDIUM (Miq.) Hensch.

VI. KEY TO SPECIES WITH PELTATE LEAVES

- a. Fruit scarcely rostrate, apex acute, mammiform, or obliquely scutelliform.
 - b. Stems very short, scarcely 1 cm. long; rachis strongly hispidulous..... 59. *P. HISPIDORHACHIS*
 - bb. Stems much longer.
 - c. Leaves pubescent beneath; petioles more than half as long as the blade, slender..... 60. *P. CERRO-PUNTANA*
 - cc. Leaves glabrous; petioles shorter, stout..... 61. *P. CORDULATA*
 - aa. Fruit rostrate.
 - b. Petiole attached 1-2 cm. or more from the leaf margin.
 - c. Main lateral nerves conspicuous and strongly curved toward the apex..... 62. *P. FLEXINERIA*
 - cc. Main lateral nerves rather obscure and ascending more sharply.
 - d. Leaves mostly 6-8 cm. wide..... 63. *P. CILIIFERA*
 - dd. Leaves mostly 5 cm. or less wide..... 64. *P. CONSERTA*

- bb. Petiole attached within 1 cm. of the margin.
- c. Leaves 10 cm. or more long..... 65. *P. MACULOSA*
- cc. Leaves 3 cm. or less long..... 66. *P. PERGLANDULOSA*

59. *PEPEROMIA hispidorhachis* Yunccker, sp. nov.

Herba parva epiphytica; caule per breve; foliis alternis ovato-lanceolatis, apice sensim acutis, basi rotundatis ca. 5 mm. et basi peltatis utrinque dissite crispe-villosis (pilis usque ad 1 mm. longis), ciliatis, palmatim 7-9-nerviis luteo-glandulosopunctatis; petiolo gracili 4-5 mm. longo dissite villoso, ad basim dilatato; spicis axillaribus; pedunculo filiformi spicam ipsam aequante, rhachi conferte hispido; drupa angusto-elliptoidea, breve-pedicellata, apice subobliquo, stigmate apicali.

A small, epiphytic plant; stem very short, scarcely 1 cm. long \times 3 mm. thick, tumid with thickened leaf scars; leaves alternate, ovate-lanceolate, apex gradually acute, base rounded, peltate about 5 mm. above the base, 2.5-4 cm. wide \times 6-8.5 cm. long, loosely crisp-villous on both sides, the hairs up to 1 mm. long, ciliate, palmately 7- or in large leaves faintly 9-nerved, the innermost pair of lateral nerves coalescing with the midrib within the lowermost 5-10 mm., the lateral nerves simple or in large leaves more or less forked, drying very thin, pellucid, yellow-glandular-dotted; petiole slender, 4-5 cm. or more long, loosely villous, base much enlarged; spikes axillary, scarcely 1 mm. thick, 7-9 cm. or more (?) long, loosely flowered; peduncle filiform, about as long as the spike, loosely villous; rachis densely and prominently hispid; bracts round-peltate; fruit narrowly ellipsoidal, apex slightly oblique, narrowed toward the base to form a short stalk, stigma essentially apical.

Fig. 21. *Peperomia hispidorhachis*

Known only from the type locality.

PANAMÁ: Río La Maestra, alt. 0-25 m., Dec. 4, 1936, Allen 31 (Herb. Missouri Bot. Gard., TYPE).

This species bears some resemblance to *P. tecticola* of Costa Rica. It differs, however, according to DeCandolle's description, because of the leaf shape, shorter spikes, hispid rachis, and shape of the substalked fruit. It closely resembles *P. Killipi* in general appearance. It differs, however, because of its villous, definitely peitate leaves, strongly hispid rachis, and fruit shape.

60. *PEPEROMIA CERRO-PUNTANA* Trel. in Ann. Mo. Bot. Gard. 27:301. 1940.

A terrestrial or epiphytic mountain herb; stem 2-3 mm. thick, more or less decumbent and rooting from the lower nodes, glabrous, internodes 2-5 or 6 cm. long; leaves alternate, round-ovate or ovate, apex slender-acuminate, base round, obtuse, peltate about 1 cm. from the margin, 4-5 cm. wide \times 6-8 cm. long, glabrous above, loosely pubescent beneath, the hairs about 0.5 mm. long, drying rather membranous, translucent; petiole slender, up to 7 cm. long, clasping, sparsely hairy glabrescent; spikes leaf-opposed, 2-3 mm. thick \times 7-12 cm. long, moderately flowered; peduncle 2-3 mm. long, pubescent; rachis somewhat papillate; bracts



round-peltate; ovary obovoid-turbinate, stigma apical.

Mountains of Chiriquí province.

CHIRIQUÍ: trail from Cerro Punta to headwaters of Río Caldera, alt. 2250-2500 m., Allen 1451; Bajo Chorro, Boquete District, in rain forest, alt. 1800 m., Davidson 219.

The peltate leaves with villous lower surface, rather long spikes, and subturbinate ovary with apical stigma are distinctive characters of this species.

61. *PEPEROMIA CORDULATA* C.DC. in Jour. Bot. 4:137. 1866.

A pendent, glabrous, epiphytic herb; stem 5 mm. thick when dry, internodes 2-4 or 6 cm. long; leaves alternate, round-ovate or ovate, apex acute to subacuminate, base rounded, peltate within 1 cm. of the margin, 5-8 cm. wide \times 7-11 cm. long, palmately about 11-nerved, drying rather firm, subtranslucent; petioles stout, 2-3 mm. thick, 1-4 cm. long; spikes on short, bracteate, leaf-opposed branches, 2 mm. thick \times 15 cm. long, densely flowered; peduncle 1.5-2 cm. long, bracts rather large, lanceolate; floral bracts round-peltate; fruit subglobose, apex obliquely truncately scutelliform, stigma central.

Panama.

CANAL ZONE: near Madden Dam and along Azote Caballo Road near Alahuela, alt. 90-100 m., Dodge 16595. COLÓN: Chagres, Fendler 265.

62. *PEPEROMIA flexinervia* Yuncker, sp. nov.

Herba repens terrestris carnosula fere tota glabra; foliis alternis, rotundato-ovatis, apice sensim acute acuminatis, e basi rotundatis vel cordatis, peltatis ad 15 mm. procul ex margine, ex petiolo 7-9-nerviis, conferte ciliatis, glanduloso-punctatis; petiolo usque ad 16 cm. longo; spicis axillaribus, usque ad 20 cm. longis, singulis e caudiculo 1-2-bracteato; ovario ovoideo, rostrato.

A repent, succulent, terrestrial, essentially glabrous herb; stem creeping, 3 mm. thick when dry, rooting at the nodes, "densely pink-spotted," internodes 6-10 cm. or more long; leaves alternate, round-ovate, apex attenuately sharp-acuminate, base rounded to cordate, peltate within 15 mm. of the margin, rather prominently 7- to 9-nerved from the petiole, the lateral nerves strongly curving toward the apex, the innermost pair slightly coalescent with the midrib which is faintly branched upward, 7-9 cm. wide \times 12-15 cm. long, glabrous, yellow-glandular-dotted, densely ciliate, drying firm, subopaque, finely pellucid-dotted; petiole up to 16 cm. or more

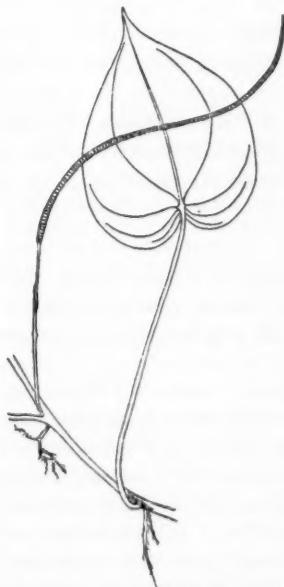


Fig. 22. *Peperomia flexinervia*

long; spikes axillary, up to 20 cm. or more long, solitary or sometimes multiple (?), on a 1- or 2-bracted stalk up to 10 cm. or more long, bracts 2 cm. or more long, narrowly lanceolate; floral bracts round-peltate; ovary ovoid, rostrate, stigma at the base of the beak; fruit not developed.

Known only from the type locality.

COCLÉ: Las Minas, Sept. 1, 1941, Allen 2738 (Herb. Missouri Bot. Gard., TYPE).

This species resembles *P. parvata* of Costa Rica but differs in the creeping habit of growth, and type of venation. From *P. maculata* it differs especially in the shape of the leaves and type of venation.

63. *PEPEROMIA CILIIFERA* Trel. in Contr. U. S. Nat. Herb. 26:212. 1929.

Peperomia bernardifolia (Vahl) A. Dietr. var. *ciliifera* Trel. in Bot. Gaz. 73:145. 1922.

A repent, glabrous, vine-like herb; stem 3-4 mm. thick when dry, rooting at the nodes, internodes up to 12 cm. or more long; leaves alternate, round-ovate, apex abruptly sharp-acuminate, base round, obtuse, peltate 2-3 cm. from the margin, rather densely ciliate, at least when young, 6-10 cm. wide \times 9-15 cm. long, obscurely about 9-nerved from the petiole, drying dark, coriaceous, opaque; petioles up to 12 cm. long; spikes solitary, closely flowered, 2 mm. thick \times 6-10 cm. long, on axillary, 1-bracteate stalks; peduncle about 1 cm. long as represented; bracts round-peltate; fruit ellipsoidal, rostrate, stigma anterior at the base of the recurved beak.

Mountains of central Costa Rica and adjacent Panama.

CHIRIQUÍ: Boquete Region, Cerro Horqueta cloud forest, on fallen trees, alt. 1950 m., von Hagen & von Hagen 2155.

The specimen from Panama agrees in all essential characteristics with this species. The spikes are not fully developed and are somewhat fragmentary, but so far as can be determined they agree well with Trelease's description of those of *P. ciliifera*.

64. *PEPEROMIA CONSCERTA* Yuncker, sp. nov.

Herba glabra repens carnosa epiphytica; foliis alternis, ovato-ellipticis, apice acuminatis, basi rotundatis ex lamina 1-2 cm. peltatis, obscure palmatim 9-nerviis, sat conferte ciliatis, minute pellucido-punctatis; petiolo gracili; spicis terminalibus axillaribusque; drupa globoso-ovoidea rostrata.

A repent, spreading, epiphytic, glabrous herb; stem 3 mm. thick when dry, internodes up to 10 cm. or more long, rooting at the nodes; leaves alternate, ovate-elliptic, apex sharp-acuminate, base rounded, obtuse, peltate 1-2 cm. from the margin, 4-5 cm. wide \times 6-8 cm. long, obscurely palmately 9-nerved, margin strongly ciliate, drying coriaceous, narrowly revolute, opaque, finely pellucid-dotted; petiole slender, variable in length, 4-10 cm. long; spikes terminal and axillary, 2 mm. thick \times 8 cm. long, closely flowered; peduncle 10-15 mm. long; bracts small, round-peltate; fruit globose-ovoid, about 0.8 mm. long, rostrate, stigma anterior, near the base of the equilong, rather thick, granulate, curved,

blunt beak. — COLOMBIA: CAQUETÁ: Cordillera Oriental, in forest between Sucre and La Portada, alt. 1200–1350 m., April 5, 1940, *Cuatrecasas* 9120 (Nat. Herb. Colombia, TYPE; fragment in U. S. Nat. Herb.).

Southern Colombia and Panama.

PANAMA: CHIRIQUÍ: Bajo Chorro, Boquete District, rain forest, alt. 1800 m., Jan. 10, 1938, *Davidson* 85.

So far as it has been possible to determine, the Panamanian specimen agrees in all essential characters with the one from Colombia.

65. *PEPEROMIA MACULOSA* (L.) Hook. Exot. Fl. 2:pl. 92. 1825.

Piper maculosum L. Sp. Pl. 1:30. 1753.

Peperomia variegata Ruiz & Pav. Fl. Peruv. & Chil. 1:33, pl. 52, f. 2. 1798.

Peperomia septuplinervia C.DC. in Jour. Bot. 4:142. 1866.

Peperomia monsteraifolia Griseb. Cat. Pl. Cub. 64. 1866.

Peperomia leridana Trel. in Ann. Mo. Bot. Gard. 27:303. 1940.

Peperomia tenebraegaudens Trel. loc. cit. 305. 1940.

Peperomia Scheryi Trel. loc. cit. 28:426. 1941.

A rather large, sparingly hairy to glabrate, assurgent, succulent herb; stem spotted when growing, up to 10 mm. thick and ascending to 20 or 30 cm., rooting from the nodes of the decumbent basal part; leaves alternate, peltate within 1 cm. of the margin, elliptic-ovate, 6–11 cm. wide \times 10–18 cm. long, apex abruptly short-acuminate, base rounded or truncately subcordate, rather faintly 7- to 11-plinerved below, or large leaves with as many more branches above the middle, drying dull and opaque, somewhat pubescent or glabrate; petiole 6–15 cm. long, fleshy, pubescent or glabrate; spikes terminal, solitary or paired, up to 25 cm. long; peduncle up to 5 cm. long, pubescent or glabrate; bracts round-peltate; fruit ellipsoidal, rostrate, stigma at the base of the curved beak.

West Indies, northern South America, and Panama.

CHIRIQUÍ: Finca Lérida to Boquete, alt. 1300–1700 m., *Woodson, Allen & Seibert* 1176; Bajo Mona, mouth of Quebrada Chiquero, along Río Caldera, alt. 1500–2000 m., *Woodson, Allen & Seibert* 993; Bajo Mona, Boquete District, alt. 1350 m., *Davidson* 486; forests around El Boquete, alt. 1000–1300 m., *Pittier* 2984; Quebrada Velo, alt. 1800 m., *Woodson & Schery* 247; Boquete, Boquete District, alt. 1140 m., *Davidson* 727.

All the specimens seen from Panama are less pubescent than those which have been examined from the West Indies and South America. *P. variegata* was described as glabrous and the Panamanian specimens agree in this particular. There is so much variation in this character among individual plants, however, that it does not appear advisable to base specific or varietal distinctions on it. It has been impossible to recognize *P. tenebraegaudens*, *P. Scheryi*, and *P. leridana* as distinct species, although they differ somewhat in the texture of the dried plants, leaf size, length of spikes, etc. None of these characters, however, appear sufficiently distinctive to warrant specific or varietal recognition. Field studies and mass collections are required to provide evidence for proper segregation of these questionable species, if such is indicated. All specimens seen from Panama are from an altitude of 1000–2000 meters in the mountains of Chiriquí.

66. *PEPEROMIA perglandulosa* Yuncker, sp. nov.

Herba epiphytica repens carnosa; caule conferte rubro-villoso; foliis alternis deltoideo-ovatis, apice rotundatis, basi truncatis, plerumque subpeltatis, palmatim 5-nerviis, supra glabratibus subtus pubescentibus saltam ad costam conferte ciliatis utrinque conferte rubro-glanduloso-punctatis; petiolo 1.5-4 cm. longo conferte rubro-villoso, dissite rubro-glanduloso-punctato; spicis oppositifoliis; pedunculo 2.5 cm. longo conferte rubro-villoso ad medium bracteato; ovario ellipsoideo acute rostrato.

A repent, succulent, epiphytic herb; stem 2 mm. thick, densely red-villous, rooting at the nodes, internodes 2-5 cm. or more long; leaves alternate, deltoid-ovate, apex rounded, base truncate, mostly subpeltate with the petiole attached 1-2 mm. from the margin, palmately 5-nerved, the laterals slender and obscure, glabrescent above, pubescent beneath, at least along the midrib, the margin densely ciliate with a zone of submarginal hairs on the upper surface, 1.5-3 cm. wide \times 1.5-3 cm. long, drying rather thick and opaque, densely and conspicuously red-glandular-dotted on both sides, the glands comparatively large; petiole 1.5-4 cm. long, densely red-villous, sparsely red-glandular; spikes leaf-opposed, 2 mm. thick \times 7 cm. long, densely flowered; peduncle 2.5 cm. long, densely red-hairy, with scattered red glands, bracteate near the middle; floral bracts round-peltate, conspicuously and densely red-glandular; ovary ellipsoidal, red-glandular, sharply rostrate, stigma anterior at the base of the beak; fruit not present.

Known only from the type locality.

COCLÉ: El Valle de Antón, crest of Cerro Pajita, alt. 1100 m., Sept. 28, 1946, Allen 3750 (Herb. Missouri Bot. Gard., TYPE).

The densely red-villous plants, and red-glandular leaves, bracts, etc. are distinctive features of this species.

VII. KEY TO SPECIES WITH NUMEROUS SPIKES ARRANGED IN A COMPOUND,
PANICULATE INFLORESCENCE.

(Subgenus *PANICULARIA* Miq.).

- a. Spikes scarcely more than 1 cm. long; fruit subcylindrical with oblique apex; inflorescence stalk microscopically hirtellous..... 67. *P. PERNAMBUCENSIS*
- aa. Spikes mostly 3 cm. or more long; fruit not as above.
 - b. Leaves sessile or subsessile..... 68. *P. DURICAUULIS*
 - bb. Leaves obviously petiolate.
 - c. Spikes mostly less than 10 in each panicle.
 - d. Leaves obovate, mostly 10 cm. or more wide..... 69. *P. WILLIAMSII*
 - dd. Leaves elliptic-ob lanceolate, scarcely 5 cm. wide.
 - e. Stems, leaves, etc. villous..... 70. *P. WEDELII*
 - ee. Stems glabrous..... 56b. *P. OBTUSIFOLIA* var. *LONGIRRACTEATA*
 - cc. Spikes mostly 12 or more in each panicle; leaves elliptic, elliptic-oblong, or ob lanceolate, mostly 6-8 cm. wide.
 - d. Leaves glabrous; stem only a few cm. long, scarcely erect..... 71. *P. MAMEIANA*
 - dd. Leaves pubescent, at least beneath.
 - e. Plants rhizomatous; leaves villous along the nerves beneath, glabrous above..... 70. *P. WEDELII*
 - ee. Plants with erect stems up to 100 cm. tall; leaves silky-pressed-villous on both sides..... 72. *P. SUBSTRIATA*

67. *PEPEROMIA PERNAMBUCENSIS* Miq. in Hook. Lond. Jour. Bot. 4:420. 1845.*Peperomia paniculata* Regel, in Bull. Soc. Nat. Moscou 31:542, pl. 3. 1858.*Peperomia longifolia* C.DC. in DC. Prodr. 16:405. 1869.*Peperomia multiplex* Leprieur ex C.DC. loc. cit. 406. 1869, as synonym.*Peperomia lopezensis* Trel. in Ann. Mo. Bot. Gard. 27:303. 1940.

A simple, short-stemmed, succulent, terrestrial, or epiphytic herb; stem 3-5 mm. or more thick, ascending to 5-10 cm. from a briefly decumbent, rooting base, internodes very short, glabrous; leaves alternate, elliptic, elliptic-oblong, or oblanceolate, 4-6 or sometimes up to 12 cm. wide \times 15-30 cm. long, apex sharp-acuminate, base cuneate, decurrent, pinnately nerved with 5-8 branches on each side of the prominent midrib, glabrous on both sides, minutely hirtellous at the tip, usually drying rather chartaceous and subopaque; petiole 3-5 cm. long; spikes about 2 mm. thick \times 10-12 mm. long, verticillate in a loose, terminal or axillary, spike-like paniculate inflorescence up to some 8 cm. long, on a common stalk 4-8 cm. long, the main stalk of the panicle somewhat hirtellous or puberulent; peduncles about 3 mm. long; bracts round-peltate; fruit about 1 mm. long, subcylindrical, slightly obliquely truncate at the apex, stigma central.

Northern South America and extending into southern Central America.

BOCAS DEL TORO: Fish Creek Mountains, vicinity of Chiriquí Lagoon, von Wedel 2253, 2286. CANAL ZONE: Quebrada Lopez, Allen 2118.

The leaves on the specimens seen from Panama are somewhat more elongated than most of those seen from South America and consequently do not appear as abruptly acuminate. This character which, so far as has been noted, is not supported by other differences, does not appear to be sufficient to warrant the maintenance of *P. lopezensis* as a distinct species.

68. *PEPEROMIA DURICAULIS* Trel. in Ann. Mo. Bot. Gard. 27:302. 1940.

An erect or assurgent, glabrous, leafy, terrestrial or epiphytic, alpine herb; stem 5 mm. thick downward when dry, ascending to 20-30 cm., internodes 1-3 cm. long, nodes rather prominent; leaves alternate, elliptic-ob lanceolate, apex sharp-acuminate, minutely hirtellous, base cuneate-decurrent, 3-4.5 cm. wide \times 10-13 cm. long, pinnately nerved, the nerves 5-6 on each side of the prominent midrib, drying submembranous, translucent, faintly but densely pellucid-dotted; petiole very short, broadly winged to the base by the decurrent blade, the wings clasping the stem; spikes 1 mm. thick \times 3-5 cm. long, in umbels of usually 3-5 spikes in the axil of a lanceolate bract, the umbels alternately arranged in an open, divaricate, paniculate, axillary inflorescence eventually up to 15 cm. or more long, the basal part to the first umbel up to 7 cm. long in anthesis; peduncle of individual spike 5-10 mm. long; floral bracts round-peltate; fruit ellipsoidal, rostrate, stigma at the base of the elongate beak.

Southwestern Panama.

CHIRIQUI: trail from Cerro Punta to headwaters of Rio Caldera, alt. 2250-2500 m., Allen 1441; Bajo Chorro, Boquete District, alt. 1800 m., Davidson 299.

69. *PEPEROMIA WILLIAMSII* Trel. in Contr. U. S. Nat. Herb. 26:48. 1927.*Peperomia flavispica* Trel. loc. cit. 1927.

A glabrous, succulent, subsimple, arboricolous herb; stem up to 1 cm. thick when dry, rather short, internodes 2-3 cm. long; leaves alternate, elliptic-obovate, apex rounded, obtuse, or abruptly acute, commonly emarginulate, base cuneate, decurrent, 9-11 cm. wide \times 15-20 cm. or more long, pinnately nerved to above the middle, the lateral nerves very slender, about 6 on each side, drying thick, glossy, coriaceous, opaque, subrevolute; petioles stout, 5-12 cm. long, winged by the decurrent blade; spikes 2 mm. thick \times 10-15 cm. long, closely flowered, several, solitary, or 2 or 3 from the nodes of a zig-zag, elongated stalk-like continuation of the stem, inflorescence up to 15 cm. or more long; peduncles of individual spikes 2-4 cm. long; rachis with anastomosing ridges; bracts round-peltate; fruit ellipsoidal, about 1 mm. long, rostrate, stigma at the base of an awl-like, equilong beak with hooked apex.

Panama.

COCLÉ: Bismarck, above Penonomé, alt. 600-900 m., Williams 433. CANAL ZONE: Las Cascadas Plantation, near Summit, Standley 25729; drowned forest near Vigia and San Juan on Río Pequená, alt. 66 m., Dodge, Steyermark & Allen 16525—leaves 5-7 \times 12-15 cm. PANAMÁ: Río Tapia, Standley 26196.

The large, succulent, obovate leaves with stout petioles and paniculately clustered spikes are distinctive features of this species. No specific differences have been noted between this species and *P. flavispica*.

70. *PEPEROMIA Wedelii* Yuncker, sp. nov.

Herba subrepens rhizomatosa epiphytica; caule dissite viloso, indumento ad 1 mm. longo, internodiis brevibus; foliis alternis oblanceolato-ellipticis, apice breviter acuminitatis, basi cuneatis, pinnatim venosis, venis utrinque ca. 5, supra glabris subtus ad venas dissite villosis; petiolo 1-3.5 cm. longo, dissite villosi; spicis in paniculam terminalem dispositis; pedunculo ca. 1 cm. longo glabro; drupa angustata erecta oblongo-cylindrica rostrata.

A subrepent, rhizomatous, epiphytic herb; stem 2 mm. thick when dry, loosely villous, hairs up to 1 mm. long, internodes short; leaves alternate, oblanceolate-elliptic, apex short-acuminate, base cuneate-decurrent, 3-5 cm. wide \times 10-15 cm. long, pinnately nerved, the lateral nerves about 5 on each side, glabrous above, loosely villous along the nerves beneath, drying rather

Fig. 23. *Peperomia Wedelii*

papery, translucent; petiole 1-3.5 cm. long, loosely villous, shallowly grooved above; spikes 1 mm. thick \times 3-6 cm. long, single or 2-3 in alternate clusters in an elongated terminal panicle, the lowermost spikes about 7 cm. above the base of the loosely villous stalk; peduncles of individual spikes about 1 cm. long, glabrous; floral bracts minute, round-peltate; fruit slender, erect, oblong-cylindrical, rostrate, stigma anterior at the base of the short, flexible beak.

Known only from the type locality.

BOCAS DEL TORO: Fish Creek, vicinity of Chiriquí Lagoon, April 9, 1941, *H. von Wedel 2005* (Herb. Missouri Bot. Gard., TYPE).

This species appears to be rather closely related to *P. calvifolia* of Costa Rica. It differs, however, in the pubescence of the stem, leaves, etc., fewer lateral leaf nerves, longer petioles and spikes, etc.

71. *PEPEROMIA MAMEIANA* C.DC. in Candollea 1:290, 396. 1923, as *P. mamaiana* C.DC. in Candollea 2:188. 1925.

A glabrous, rather succulent, rhizomatous herb, on rocks and trees; stem 4-8 mm. thick when dry, rooting at the nodes, internodes 1-2 cm. long; leaves alternate, elliptic, lance-elliptic, or subob lanceolate, apex acute, base cuneate-decurrent, 4-10 cm. wide \times 15-25 cm. long, obscurely pinnately nerved, the nerves 6-7 on each side of the stout midrib which continues to the very apex, drying rather glossy, coriaceous, opaque, narrowly revolute; petiole stout, up to 10 cm. long, channelled and winged upward by the decurrent blade; spikes 1-1.5 mm. thick \times 6-12 cm. long, densely flowered, loosely paniculate on long, stout, axillary or terminal stalks, the entire inflorescence up to 30 cm. or more long; peduncles 1-5 cm. long; rachis with anastomosing ridges; bracts round-peltate; fruit scarcely 1 mm. long, ellipsoidal, rostrate, stigma anterior at the base of the curved beak.

Central Panama.

CANAL ZONE: Mamei Hill, alt. 20-90 m., *Pittier 3805*; vicinity of Las Cruces, alt. 26-40 m., *Seibert 571*; Barro Colorado Island, *Kenoyer 303*; near Salamanca Hydrographic Station on the gorge of the Río Pequeni, alt. 70-80 m., *Dodge, Steyermark & Allen 16525a*; Experimental Gardens, *Lindsay 402a*.

72. *PEPEROMIA SUBSTRIATA* C.DC. in Candollea 1:291. 1923.

A moderately large herb; stem somewhat silky-pubescent, erect or scandent, rooting at the nodes, with erect branches, up to 5 mm. thick when dry, internodes up to 7 cm. or more long; leaves alternate, elliptic, apex short-acuminate, base acute, 2-4 cm. wide \times 4.5-8 cm. long or up to 6.5 \times 16 cm., pinnately nerved nearly throughout, the lateral nerves 6-8 on each side, appressed silky-villous on both sides, drying rather thick, opaque; petiole up to 6 cm. long, moderately appressed silky-villous, channelled and narrowly winged; spikes 2 mm. thick \times 6-10 cm. long, closely flowered, several on a bracted, silky-villous stalk 3 cm. or more long; bracts large, foliar, elliptic-obovate, sparingly silky; peduncle of indi-

vidual spikes 5–10 mm. long; floral bracts round-peltate, glandular-dotted; fruit ellipsoidal, about 1 mm. long, rostrate, stigma anterior near the base of the beak.

Costa Rica and adjacent Panama.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, alt. 1800–2100 m., *Allen 4950*. CHIRIQUÍ: Bajo Chorro, Boquete District, rain forest, alt. 1800 m., *Davidson 217*.

